November 12, 2013

Ray Hoffman, Director
Seattle Public Utilities
700 Fifth Avenue, Suite 4900
PO Box 34018
Seattle, WA 98124

Subject: Expert Panel Comments and Recommendations on the Integrated Plan

Dear Mr. Hoffman:

Thank you for providing us the opportunity to participate in the Expert Panel for Seattle Public Utilities' (SPU) Integrated Plan. We appreciate the opportunity to provide technical input on the methodology that SPU is planning to use for its Integrated Plan. This plan will be submitted to the U.S. Environmental Protection Agency and the Washington State Department of Ecology as part of SPU's Long Term Control Plan (LTCP) for controlling combined sewer overflows (CSOs). The Integrated Plan is an important effort for the City of Seattle (City). It allows the City to evaluate the relative water quality benefits of a variety of alternative stormwater and CSO control projects. Based on this evaluation, the City is planning to request from its regulators the ability to invest in projects that will likely produce significantly better water quality outcomes for the community while meeting or exceeding the overall intent of regulatory requirements.

Role of the Expert Panel and the Integrated Plan Option in the City's Consent Decree

Our role as the Expert Panel was to provide input on the data, methods, and assumptions that SPU is using to develop the Integrated Plan. We acted as a technical sounding board for SPU, reviewing and commenting on technical questions and issues relevant to the methodology. We did not, however, review or comment on SPU's potential decisions about final project selection. Our process included participating in three face-to-face meetings and three group conference calls, as well as reviewing technical materials provided by SPU before and after meetings. The observations that we made at each of the Expert Panel meetings and calls were documented in summaries of those meetings (attached).

As outlined in the City's consent decree, which was lodged on July 3, 2013, the City may propose alternative water quality improvement projects (stormwater projects) in the Integrated Plan that will result in significant benefits to water quality beyond those that would be achieved by implementing the approved CSO control measures only. The City would proceed with these stormwater projects and defer selected CSO control measures that it determined would result in significantly less benefit to water quality than would the stormwater projects. The CSO control measures selected for deferral are referred to as "low-benefit CSO control measures." If the Integrated Plan is approved, the City would defer implementation of these low-benefit CSO control measures until after 2025 and then implement both

the stormwater projects proposed in the Integrated Plan and the higher benefit CSO control measures in the LTCP by 2025. Regardless of the stormwater and CSO control projects the City implements, the City must meet Clean Water Act and Washington Water Pollution Control Act requirements.

We understand that the City has a long history of CSO and stormwater control research and implementation, and that SPU has controlled most of the CSO volumes under its jurisdiction. Seattle has reduced its annual CSO discharge volumes by more than 99 percent, from an estimated 20 to 30 billion gallons in the 1960s to 154 million gallons in 2012. SPU also has a stormwater management program that manages 6,400 million gallons per year of runoff volume. This history of CSO and stormwater control research and implementation in the City provides context for understanding the range of alternatives that SPU is considering for the Integrated Plan.

Work Completed on the Integrated Plan and Discussed with the Expert Panel

Our understanding is that SPU and the Integrated Plan consultant teams have completed the following work to date on the Integrated Plan:

- Identified low-priority CSO control projects that address low-volume, low-frequency CSOs (i.e., nearly controlled) to consider for deferral in the Integrated Plan.
- Identified potential stormwater pollution control projects to consider for inclusion in the Integrated Plan through a process that examined receiving water body rankings, pollutant and flow estimates, and the cost-effectiveness of different treatment alternatives within each basin.
- Selected representative constituents of concern (RCOCs) for the pollutants identified in the consent decree.
- Estimated the pollutant load reductions that would be attained from the CSO projects to be deferred using calibrated hydrologic and hydraulic models of the combined sewer system.
- Estimated the pollutant load reductions that would be attained from the stormwater projects (other than street sweeping) based on information about volume, land use, and best management practice effectiveness.
- Developed estimates of pollutant load reductions from street sweeping projects based on information about pickup rates and sample concentration data from past sweeping efforts, anticipated curb-miles swept, and local studies about washoff pollutant loads and concentrations.
- Conducted a relative assessment of the effects of the stormwater and CSO projects on exposure to ecological receptors and exposure to human health receptors (considering acute exposure to bacteria separately from chronic exposure to toxic pollutants).
- Identified criteria—including criteria for positive environmental outcomes, social good for the community, external drivers, technical feasibility, and life-cycle cost—to use to evaluate projects through multi-objective decision analysis (MODA) to select the final set of stormwater and CSO projects in the Integrated Plan.

Observations and Recommendations

Based on the information provided to us, our major observations about the Integrated Plan methodology, data, and assumptions include the following:

- The results of SPU's analysis show that the stormwater projects SPU is considering for the Integrated Plan, in part or in whole, provide significant net benefits to receiving water quality compared to the CSO projects SPU may propose to defer.
  - The considerable difference in discharge volume reductions of the stormwater projects compared to the CSO projects drives much of these benefits.
  - We believe SPU can create a set or sets of stormwater projects that yield significantly better water quality outcomes than the set of CSO projects to be deferred, even though any individual CSO project to be deferred may provide modestly greater benefit for one or a few of the water quality parameters relative to one or a few of the individual stormwater projects.
- SPU has based its methodology for the exposure assessment on standard procedures for ecological risk assessment, and enhanced those procedures based on project-specific data and assumptions relevant to the task of creating relative exposure assessments. We explored this methodology in some detail in our meetings, and believe it is reasonable but operationally complicated. The complexity derives from the number of assumptions and subjective scaling factors that are necessary to incorporate the available data and conduct a relative assessment of the effects of the proposed projects on exposures to ecological and human receptors.
- We reviewed SPU's methodology for estimating the pollutant load reductions from street sweeping projects specifically, and believe that SPU's approach to the methodology, use of data, and assumptions is reasonable. We also believe that it is important for SPU to characterize the uncertainty in its estimates for street sweeping projects.
- In SPU's analysis of the differential benefits from projects, we believe it is important to consider not only the magnitude of pollutant load reduction benefit or exposure reduction benefit from projects, but also the importance of those changes. For example, depending on how ranges are normalized in the analysis, changes that occur at or near ecological and/or human health thresholds could appear to be equivalent to similar magnitude changes that occur far from those regulatory thresholds, even though the relative "importance" of those changes differs.
- We appreciate that SPU has highlighted areas of uncertainty and data gaps in its analysis thus far. We believe it will be important to appropriately document these data gaps, areas of uncertainty, and confidence intervals in the Integrated Plan and supporting materials.
- Overall, we feel that SPU and the consultant team used an innovative, scientifically sound, and understandable approach to evaluating stormwater and CSO projects in the Integrated Plan according to the consent decree requirements, and that this approach has thus far produced results that are defensible and reasonable.

- We also believe that future integrated planning processes in other jurisdictions need not be as extensive, exhaustive, or complicated as this to make these types of decisions. However, because SPU is leading nationally on integrated planning, we agree that such a robust approach was worthwhile here.

Our recommendations to SPU for the Integrated Plan include the following:

- While it is important to articulate the uncertainty inherent in an analysis such as SPU has done, the focus on uncertainty should not obscure the overall message that the stormwater projects to be proposed in the Integrated Plan are expected to produce significantly greater reductions in pollutant loads and exposures to human and ecological receptors than the CSO projects to be deferred.
- In the final selection of stormwater projects for the Integrated Plan, we understand that SPU is considering the tradeoffs between potentially competing objectives through a systematic multi-objective decision analysis (MODA) process. We believe that this analysis would be stronger if it incorporated the concept of utility curves, which would allow normalization of the units and which would consider non-linear cause-and-effect relationships in the MODA criteria. If SPU does not choose to use utility curves in this analysis, it should document its rationale for this decision.
- Post-construction monitoring of the performance of the CSO and stormwater projects in the Integrated Plan will be important to demonstrate the projects meet consent decree requirements. SPU should also use post-construction compliance monitoring to address uncertainties and data gaps in its analysis and add to the stock of knowledge associated with the stormwater best management practices, including street sweeping. Performance monitoring of areas likely to be affected by the planned CSO and stormwater projects should begin as soon as feasible to provide a useful "before implementation" baseline for subsequently evaluating project effectiveness.

Upon reflection about the transferability of this approach to other jurisdictions that are considering the development of an Integrated Plan, we offer the following observations:

- The analysis that SPU and its consultant team conducted was applied to a specific set of high-value stormwater projects compared to a specific set of low-priority (low-frequency/low-volume) CSO projects. This set of projects was specific to Seattle, but a different suite of CSO and stormwater projects, both in Seattle and in other communities, would not necessarily demonstrate similar anticipated water quality benefits. As a result, communities across the country can learn a great deal from the structure of SPU's analysis but must realize that the implementation in each community will be specific to their unique history, land use, governance, and other factors.
- While it is important to carefully examine and document the comparative water quality benefits of CSO and stormwater projects through Integrated Planning processes, we do not believe that other communities will necessarily need to conduct the same level of analysis or data utilization to demonstrate differences in anticipated water quality benefits. In particular, the data analysis should not need to be as complicated, exhaustive, or costly to make these types of decisions about the comparative water quality benefits of projects. It may also be appropriate for other communities to

evaluate significant benefits differently, such as by considering co-benefits from stormwater projects and/or the cost-effectiveness of projects.

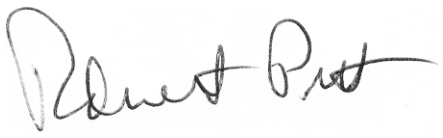
- The MODA criteria will always be jurisdiction-specific and should not be "exported" elsewhere without careful consideration of their local applicability and need. Excess attention to these ancillary considerations may risk losing sight of the primary purpose of an Integrated Plan, namely to achieve greater improvements in water quality more rapidly and at reduced cost.

We look forward to hearing how SPU uses the methodology we have reviewed to select projects for the Integrated Plan and to document how the projects meet the consent decree requirements. Please keep us informed as SPU selects stormwater and CSO projects for the Integrated Plan and as the LTCP and Integrated Plan go through review by the regulatory agencies.

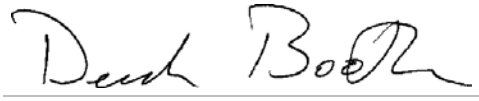
We appreciate the opportunity to assist SPU in its development of the technical methodology for its Integrated Plan.

Sincerely,

Robert Gearheart, Ph.D., P.E., Chair
Professor Emeritus, Humboldt State University, Arcata, CA



Robert Pitt, Ph.D., P.E., BCEE, D.WRE
Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL



Derek Booth, Ph.D., P.E., P.G.
Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA

Jeanmarie Zodrow, Ph.D.
Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO

Kyle Dreyfuss-Wells
Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH

CC: Nancy Ahern, Deputy Director, Utility Systems Management, SPU
Andrew Lee, CSO Program Manager, SPU
Kevin Buckley, Integrated Plan Project Manager, SPU

Enclosures

Seattle Public Utilities Integrated Plan Expert Panel
Meeting (Call) #1, March 14, 2013
Call Summary

Call Objectives

- Review and clarify the purpose and responsibilities of Expert Panel members
- Answer questions about SPU's Stormwater and CSO Programs and the Integrated Plan option in SPU's Consent Decree
- Discuss the scope of the Expert Panel's discussions, including questions the Expert Panel will be asked to consider
- Review upcoming meeting plans and identify next steps

Summary

Opening Remarks

- Kevin Buckley of Seattle Public Utilities (SPU) welcomed members of the Expert Panel. He described the importance of the Integrated Plan as an opportunity for Seattle, and noted that the methodology also could be used to evaluate stormwater projects in the future.
- Bob Gearheart, the Expert Panel chair, also welcomed the group and thanked members for their participation.

Schedule for the Expert Panel and Integrated Plan

- The Integrated Plan is being developed along with the combined sewer overflow (CSO) Long Term Control Plan (LTCP), a draft of which is due to EPA and the Washington State Department of Ecology in May 2014 (final in May 2015).
- The Integrated Plan has a similar process to the LTCP and the same final deadlines but the work on the Integrated Plan started much later.
- During the development of the LTCP and Integrated Plan SPU is doing quarterly updates with EPA and the Washington Department of Ecology as well as public outreach and engagement activities.
- The Expert Panel will be meeting at least three more times this summer and fall, as follows.
    - **Expert Panel Meeting #2 (April 29, in Seattle):** This meeting will include a review and discussion of the pollutant estimating methodology and a discussion of how SPU is planning to use the existing data in its analysis.
    - **Expert Panel Meeting #3 (June, in Seattle):** This meeting will feature a discussion of the technical evaluation criteria SPU plans to use in the Multi-Objective Decision Analysis (MODA).
    - **Expert Panel Meeting #4 (September, potentially via web-enabled teleconference):** This meeting will review and discuss how SPU has evaluated selected CSO and stormwater projects using the technical evaluation criteria.

Expert Panel Charter Discussion

- Facilitator Bill Ross reviewed the main components of the Draft Charter for the Expert Panel with the group, including the focus on providing input on the technical methodology and data for estimating the environmental benefits from CSO and stormwater projects. SPU will be using the technical methodology, along with other factors (such as cost benefit), to make decisions about stormwater projects to include in the Integrated Plan and which CSO projects to defer.
- He noted that the objective for this group is not consensus, since the Expert Panel won't be making decisions; however, to the extent that panel members differ in their views, these will be recorded.
- Expert Panel meetings will be open to members of the public.
- The Expert Panel members did not have any questions or concerns about the charter.

Questions about SPU's Stormwater and CSO Programs, and the Integrated Plan

- Trish Rhay of Seattle Public Utilities thanked the Expert Panel members for their participation and the opportunity to help Seattle potentially develop the first Integrated Plan in the nation.
- She said that she hoped the Integrated Plan would help SPU work in all areas of its system—the combined sewer system, the fully separated system, and the partially separated system, each of which represents a third of the geographic area of the city.
- The Expert Panel asked questions of SPU about the background video presented by Trish Rhay and SPU's consent decree. The responses were as follows.
    - **LTCP and Integrated Plan Approach:** In the LTCP, SPU must control overflows to one overflow event per outfall per year by 2025. With the Integrated Plan, the compliance deadline for getting some CSO outfalls to meet that one overflow per year state standard can be later, and it allows SPU to invest in stormwater projects that will provide greater water quality benefits before 2025. It does not change the level of control (quality or frequency) for CSOs, only the compliance schedule.
    - **Deferred CSO Projects:** SPU will still implement the highest priority CSO projects, including the "big three" on Lake Washington. There are 5-10 projects that are being considered for deferral in the Integrated Plan.
    - **Relation of Stormwater and CSO Projects in Integrated Plan:** The consent decree does not specify the relationship of the deferred CSO projects and the stormwater projects in the Integrated Plan (e.g., proximity, receiving water body).
    - **Expert Panel Not in Consent Decree:** The Expert Panel is not mentioned in the consent decree. It was SPU's idea to have an Expert Panel to provide a check on the methodology for showing the difference in environmental benefit between projects.
    - **Stormwater Project Parameters:** The stormwater projects will not have to meet specific parameters. SPU is focusing on projects that will show the significant relative difference in pollutant loading reductions between the deferred CSO projects and the stormwater projects, as well as other requirements in the consent decree.

Scope of the Expert Panel's Discussion – Review of Questions for the Panel

- The Expert Panel reviewed and discussed the document, "Questions for the Expert Panel," and the section of SPU's consent decree that focuses on the Integrated Plan, pages 15-19. Highlights of this discussion include:

- The key pollutants and parameters for which the Expert Panel will be advising SPU on how to evaluate CSO and stormwater projects on are listed on page 16 of the consent decree.
- For some of these pollutants (e.g., toxic organic compounds), the data are not available, so it will be necessary to identify appropriate surrogates.
- Several of the Expert Panel members indicated an interest in a presentation on MODA. Some indicated experience using MODA, but not commercial software for it.
- The regulatory agencies will be briefed about the MODA analysis and the Expert Panel's work as part of the quarterly meetings. They also will be invited to the Expert Panel meetings and likely will follow the Expert Panel's discussions closely.
- Expert Panel members noted that the transparency of the Expert Panel process to the regulatory agencies and the public will be very important.

Next Steps

- The **next Expert Panel meeting** will be on **Monday, April 29, 2013,** in Seattle.
  - The materials for the April meeting will include a summary of the available data and how it will be used in the evaluation methodology.
  - Materials for meetings will be provided to Expert Panel members at least a week in advance to allow for review.
  - If panel members have questions about materials they'd like to have addressed, please let the facilitation team (Bill Ross or Jennifer Tice of Ross Strategic) know, so we can ensure that the appropriate technical staff are present at the meeting.
- The June and September Expert Panel meetings will be scheduled soon.
- A briefing on MODA will be scheduled for sometime before the June meeting.

Participants

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Humboldt State University (Professor Emeritus)
Derek Booth	University of California Santa Barbara
Kyle Dreyfuss-Wells	Northeast Ohio Regional Sewer District
Bob Pitt	University of Alabama
Jean Zodrow	ARCADIS U.S., Inc.
Other Participants	
Kevin Buckley	Integrated Plan Project Manager, Seattle Public Utilities
Trish Rhay	Drainage and Wastewater Division Director, Seattle Public Utilities
Mike Milne	Brown and Caldwell
Eric Strecker	Geosyntec Consultants
Bill Ross	Ross Strategic
Jennifer Tice	Ross Strategic

Seattle Public Utilities Integrated Plan Expert Panel
Meeting #2, April 29, 2013
Meeting Summary

Participants

The second meeting of Seattle Public Utilities (SPU) Integrated Plan Expert Panel was attended by the five Expert Panel members, SPU managers and staff, consultants, and observers. The audience consisted largely of SPU staff and technical consultants. A full list of attendees is at the end of the summary.

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Derek Booth	Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
Jean Zodrow	Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO
SPU and Consultant Participants at the Table	
Kevin Buckley	Integrated Plan Project Manager, SPU
Ray Hoffman	Director, SPU
Trish Rhay	Drainage and Wastewater Division Director, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic

Meeting Objectives

The objectives for the Expert Panel meeting included:

- Review and gather Expert Panel feedback on SPU's proposed methodology for evaluating the potential water quality impacts of stormwater and combined sewer overflow (CSO) projects, including whether it seems appropriate given the consent decree requirements and available data.
- Collect Expert Panel feedback on proposed approaches to using data in the methodology, including proposed metrics and representative constituents of concern for evaluation.
- Identify additional available data or data sources that could help SPU and the technical team to refine and improve the proposed methodology and analysis of stormwater and CSO projects.
- Review upcoming meeting plans and identify next steps.

A summary of the meeting discussions, organized by the agenda topic, is below. Key themes from the meeting are not attributed to individuals, but comments pertaining to individual sessions are attributed.

Summary

Opening Remarks

- SPU Director Ray Hoffman welcomed the Expert Panel and thanked members for their participation. He described the challenges Seattle is facing, including stormwater runoff, CSOs, climate change, urban streams, and a landscape that is 65 percent impermeable surfaces.
- He noted that SPU had just signed its consent decree, and has an opportunity to do an Integrated Plan, which could potentially be a model for other jurisdictions. He said the Expert Panel would be important in helping SPU with the Integrated Plan.

Key Themes from the Expert Panel's Comments

Throughout the meeting, Expert Panel members commented on SPU's proposed methodology for evaluating stormwater and CSO projects, including the use of available data and the multi-objective decision analysis (MODA) process. The following were key themes from these comments and notes about SPU's responses (individual comments and responses are also included later in the summary):

- SPU should provide information on the process and criteria it used to identify projects for consideration for the Integrated Plan, including any "fatal flaw" screening criteria and the locations of projects, as this is an important part of the project evaluation.
    - SPU Response: The Integrated Plan team is preparing a memorandum on the selection criteria that were used to help the team identify projects for consideration as part of the Integrated Plan. In general, the criteria were developed to help the team identify a list of potential projects that would meet the objectives established by the Integrated Plan, focus on receiving water bodies with water quality impairments, fit into the existing built-out environment, and provide reasonable assurance that the list of potential projects can be constructed by 2025.
- It is not clear how SPU plans to consider and evaluate benefits from projects other than pollutant load reductions and other criteria listed in the consent decree. Expert Panel members recommended that co-benefits from projects, including habitat improvements, be considered. Furthermore, some Expert Panel members expressed concern that the proposed methodology for the CSO and stormwater project evaluations could become a matter of "dueling spreadsheets" and might ignore other important factors that do not lend themselves well to quantitative comparisons.
    - SPU Response: Benefits in addition those identified in the Consent Decree will be considered as part of the MODA that SPU will use to help inform the decision process for selection of stormwater projects to propose and the identification of CSO projects to defer in the Integrated Plan. SPU will be discussing these benefits and the technical criteria for the MODA evaluation of stormwater and CSO projects with the panel members at the June 25th meeting.
- Verification monitoring, including pre-project monitoring and monitoring of receiving water quality, is important to show whether projects achieve their goals and to reduce uncertainties.
    - SPU Response: SPU will consider this input as it plans the monitoring that will be proposed as part of the Integrated Plan. Monitoring for the Integrated Plan will include a post-project monitoring plan.

- It is important that the proposed metrics match the projects (both CSO and stormwater) that are being considered, and that the proposed analytic methods match the data being evaluated (e.g., the nomographs relate to the devices).
    - SPU Response: SPU agrees that the proposed metrics for evaluating CSO and stormwater projects should be appropriate for both types of projects. The purpose of the nomograph approach is to bracket the (hydrologic and hydraulic) performance of best management practices (BMPs). The nomographs are one way to represent the uncertainty in performance expected in modeling. The performance range for the nomographs will be geared to the BMPs being considered.
    - Care must be given to how these performance ranges are used in generating output that will then be compared with the metrics. The list of proposed metrics will be refined in the coming weeks as the technical team better understands the data going into the model and the stormwater projects being considered versus the CSO projects. For example, a stormwater project is usually designed to capture higher frequency, low-intensity storm events while a CSO project is designed to capture low frequency, but higher intensity storm events, so simply comparing reduced frequency of occurrence between the two types of projects is not a fair comparison. Other metrics may be considered, such as volume reduction or phosphorus reduction, as more appropriate comparisons between projects. SPU and the technical team will update the Expert Panel as this list of metrics is refined.

Overview of Approach to CSO and Stormwater Project Evaluation

- Mike Milne of Brown and Caldwell and Kevin Buckley of SPU gave a presentation that provided an overview of SPU's approach to the evaluation of CSO and stormwater projects in the Integrated Plan. This included:
    - The consent decree requirements for analyzing pollutant load reductions and describing reductions in exposure
    - The process SPU used to prioritize receiving water bodies for the purpose of selecting locations for stormwater projects
    - The overall evaluation process, from the ranking of water bodies and selection of candidate stormwater and CSO projects to the analysis of those projects and alternative combinations using the multi-objective decision analysis (MODA) process
    - An overview of the work completed to date to compile data and develop evaluation methods
- SPU manages a stormwater system that has 6,400 million gallons of stormwater runoff annually, and a combined sewer system that discharged 154 million gallons of CSOs in 2012.

Expert Panel Comments and Responses

Scope/Criteria for the Project Evaluation:

- Derek Booth and Bob Pitt asked whether the project evaluation was only focused on pollutant loads. Derek Booth expressed concern that the analysis would only cover chemical loads rather than other benefits such as habitat improvements from stormwater projects. Kyle Dreyfuss-Wells added that many of those other benefits are not part of the consent decree.

- Mike Milne and Rob Annear of the technical team responded that pollutant loads are important, but SPU would also look at exposure, frequency, duration, flow, volume, and other issues.

- Kyle Dreyfuss-Wells noted that co-benefits from stormwater projects need to be considered as part of the analysis.
- Bob Gearheart asked about the relationship of the pollutant load evaluation and Total Maximum Daily Loads (TMDLs).
  - Technical team members noted that the pollutant load evaluation of projects for the Integrated Plan is separate from looking at the assimilative capacity of water bodies; however, the Integrated Plan analysis (and associated information from the Integrated Plan) could help with TMDL efforts in the future.

<u>Comments on the Basin Ranking and Criteria:</u>

- Bob Pitt asked whether the technical team had considered locations where there had been a lot of work done already.
  - SPU acknowledged that although most of the "low-hanging fruit" for CSO control had already been addressed, SPU did not consider prior project work in the ranking of basins and initial selection of projects.
- Jean Zodrow asked why certain salmon-bearing streams were rated as not applicable in the basin ranking results.
  - SPU clarified that the ranking focused on federally listed threatened and endangered species, which wouldn't capture the problems with pre-spawn mortality of coho salmon since coho salmon aren't a listed species in Seattle.
- Derek Booth noted that the fishable/swimmable criterion for the basin ranking is dependent on the other criteria, rather than a fully separate criterion.

<u>Comments on Stormwater Projects Being Considered and the Comparison to CSO Projects:</u>

- Kyle Dreyfuss-Wells expressed concern about how CSO and stormwater projects were being compared, and noted that it is important that stormwater projects are not asked to solve all issues associated with a watershed.
- Bob Pitt commented on the Consent Decree standard for showing that the stormwater projects are "significantly better" than the CSO projects that will be deferred.[1] He said most communities only need to show that the projects are equivalent or better. Moreover, SPU will also need to consider uncertainty.
- Kyle Dreyfuss-Wells asked about the relationship of the types of stormwater projects SPU is considering and green stormwater infrastructure.
  - SPU noted that green infrastructure (natural drainage solutions) is part of the city's code.
  - Eric Strecker of Geosyntec and Beth Schmoyer of SPU said that many of the solutions are not "green" in part because they occur in areas where there is contaminated sediment, and the Consent Decree has standards for meeting pollutant load removals such as PCBs.

[1] The consent decree language pertaining to this comment is as follows: "the City may submit…a work plan ("Integrated Plan") that proposes water quality improvement project(s) ("Proposed Project") to be implemented by the City, provided that the Proposed Project(s) will result in significant benefits to water quality beyond those that would be achieved by implementation of the approved CSO Controls Measures only."

Terminology and Definitions:

- Bob Pitt recommended that SPU be specific about its terminology and definitions.
  - Based on this comment, SPU and the Integrated Plan team have begun preparing a glossary to address this need.

Discussion of Representative Constituents of Concern for Evaluation and Proposed Metrics for Technical Comparison of Stormwater and CSO Projects

- Eric Strecker of Geosyntec provided an overview of the proposed representative constituents of concern (RCOCs) for evaluation, the data compiled on the RCOCs, the extent of stormwater characterization data and the gaps in that data, and potential metrics to use in comparing stormwater and CSO projects.
  - The stormwater characterization data is from three sites in Seattle with different land uses.
  - He noted that the technical team was continuing to analyze the data it had received. In some cases, the technical team had not yet determined how much data is above detection levels.
  - The technical team is still evaluating appropriate constituents to measure for certain RCOCs, including oil and grease, pesticides, and PBDEs.
  - The candidate metrics for evaluation presented in this session did not include the metrics for the exposure assessment.
- In response to a question, SPU clarified the relationship of SPU's and King County's stormwater and wastewater systems, noting that both agencies have CSOs within the city of Seattle, SPU has responsibility for the majority of stormwater pollution control (for all but two stormwater basins where SPU and King County have MOAs), and SPU's wastewater collection system feeds into King County's regional wastewater treatment system.
- SPU reported that Ecology has recently changed the NPDES Municipal Stormwater permit requirement for monitoring from end-of-pipe monitoring to a regional, Puget Sound-wide monitoring of receiving waters, including marine nearshore and second order streams. Municipalities across Puget Sound (NPDES Phase I and Phase II) pay in to the regional monitoring. The sites were selected randomly across Puget Sound, and this has meant that there is only one site in Seattle.
- Members of the technical team noted that metrics for evaluation could consider peak events, and benefits such as how stormwater projects could reduce peak load and reduce floods.

Expert Panel Comments and Responses

Monitoring:

- After learning about SPU's monitoring of receiving waters, Bob Pitt commented that it would have been better if SPU had conducted monitoring that could show a connection between water quality in the pipes and in the receiving waters.
  - Jonathan Frodge of SPU noted that the best data showing increased body burden of pollutants associated with stormwater are from the National Mussel Watch Contaminant Monitoring program.
- Bob Pitt recommended that SPU start pre-project monitoring soon, and said that verification monitoring was critical.

Comments on RCOCs:

- Bob Pitt cautioned against using five-day biological oxygen demand (BOD) to evaluate stormwater projects, as the analytical method can give distorted results. This is particularly a problem for measuring dissolved oxygen in sediments. The ultimate BOD (or also looking at the chemical oxygen demand, COD) is more accurate than the five-day measure.
    - Based on this comment, Geosyntec will further investigate how to characterize BOD when ultimate BOD was not measured but five-day BOD was included in the sampling events. There are a few alternatives to address this issue.

Comments on Candidates for Comparison Metrics:

- Bob Gearheart and Kyle Dreyfuss-Wells asked about the sediment issues that were being considered. Legacy sediments will be mobilized in different runoff events.
    - Eric Strecker said that the evaluation is considering both minimizing recontamination of remediated legacy sediment sites and reducing new sediment loads. The idea is that retrofitting an area will reduce or prevent mobilization of certain sediments.
- Kyle Dreyfuss-Wells noted that it is important for there to be a connection between the projects and the metrics that will be used to evaluate them. It was not clear that some of the projects would have the types of benefits listed. Many of the CSO projects would not have the benefits.
- Derek Booth commented that the "frequency of untreated discharges" metric did not seem appropriate for stormwater projects, and therefore it was not useful for comparing CSO and stormwater projects. He said the benefits from projects come from attributes other than frequency of discharges, and that it would be disingenuous to consider green stormwater infrastructure as "treatment."
    - Eric Strecker said that the technical team would work on that metric. He mentioned that one attribute they were considering was volume reduction.

Discussion of Pollutant Estimation Methodology for Stormwater and CSO Projects

- Rob Annear of Geosyntec gave a presentation on the proposed methodology for estimating pollutant loads from stormwater projects. His presentation covered:
    - Understanding baseline conditions and developing a pollutant load model to estimate average annual runoff volumes, pollutant loads, and pollutant concentrations
    - The stormwater structural projects and programmatic measures SPU is considering in the Integrated Plan evaluation
    - The process proposed for estimating and evaluating the expected performance of stormwater projects, factoring in conceptual design parameters, variability, and uncertainty
- He noted that the technical team proposes using pre-processed nomographs for evaluating hydrology and hydraulics (H&H) performance, where possible, rather than facility-specific models.
- Justin Twenter of Brown and Caldwell presented on the technical team's proposed methodology for estimating pollutant loads from CSO projects. His presentation covered:
    - The CSO projects SPU is considering to defer as part of the Integrated Plan
    - Information on the CSO basins from modeling conducted for the long-term control plan (LTCP)
    - Four potential approaches for evaluating deferred CSO projects: source area evaluation, land-use evaluation, CSO characterization, and/or a hybrid approach

- The 10 potential CSO projects to defer would reduce out of compliance volume by 10 million gallons per year on average.
  - SPU is doing an environmental impact statement, which will describe the potential impacts of the projects. In general, they will involve local disturbance during construction. For example, SPU needs to find seven storage tanks to control four million gallons of overflow in a waterfront area of Seattle. Green infrastructure projects also can be disruptive (e.g., to parking).
  - The 10 CSO projects represent about 20 percent of the projects in the long-term control plan.
- Trish Rhay of SPU noted that without the Integrated Plan, all the CSO projects would have to be built by 2025, for a cost of $500-$550 million. With the Integrated Plan, SPU can propose to defer some of those CSO projects, proposing other completion dates, and then implement stormwater projects between now and 2025 that could provide greater water quality benefits. SPU is assuming that these stormwater projects would be done without increasing the cost through 2025.
- SPU staff and the technical team noted that because of the requirements of the consent decree for the Integrated Plan, SPU would need to evaluate the CSO projects being considered for deferral according to additional water quality parameters.
- There is not much public reaction to CSOs in Seattle, which mostly occur in the winter. SPU and King County have a website that shows where CSO outfalls are and when they are overflowing.
- Overflows are evaluated on a 20-year rolling average, so if there are 21 overflows at one site in 20 years the CSO is in violation of the one overflow per outfall per year standard. Seattle's NPDES permit is on a five-year window.

Expert Panel Comments and Responses

Selection of Projects for Consideration:

- Derek Booth commented on the projects that SPU had selected for consideration for the Integrated Plan, and asked for more information about the process SPU used to get to the initial list. He thought the Expert Panel could have provided input on that phase of the evaluation.
  - Kevin Buckley of SPU explained that SPU's process for identifying stormwater projects included prioritizing the basins and looking at the goals for the water bodies, evaluating technologies and green infrastructure options for meeting the goals, estimating the cost per weight of total suspended solids (TSS) removed for the potential solutions, and reviewing the options with management. He noted that SPU selected a list of stormwater projects for the Integrated Plan evaluation that went far beyond the number needed for the Integrated Plan, in order to ensure that there would be a healthy menu of options to evaluate, while not being an overly exhaustive list that would be too time consuming to optimize.
- Kyle Dreyfuss-Wells and Bob Pitt asked about whether the projects were limited to those that were under SPU's control or whether they could include projects with private landowners. In Kansas City, the efforts with private land were done simultaneously to those on public land.
  - Kevin Buckley and Tracy Tackett of SPU said that there were some constraints on the projects selected, since SPU needed to have assurance that the projects will be completed for the Consent Decree. One of the stormwater alternatives focuses on retrofitting neighborhood blocks for natural drainage; this focuses on the right-of-way, but it could be expanded to include the RainWise program, which affects private property.

- Bob Pitt asked about the street sweeping projects planned, and noted that the current street sweeping efforts could be evaluated for their effects on receiving water quality.
  - Shelly Basketfield of SPU described Seattle's street sweeping program, and that the projects being considered for the Integrated Plan would increase both the frequency of sweeping and the coverage. SPU is evaluating whether street sweeping is cost-effective in areas that do not have curbs.
  - Beth Schmoyer of SPU noted that SPU did a mass balance analysis for the street sweeping pilot in 2007-08, but acknowledged the utility does not have stormwater monitoring data.
- Kyle Dreyfuss-Wells asked why green stormwater infrastructure (GSI) / natural drainage solutions were considered part of the CSO projects, not the stormwater projects.
  - SPU staff said that the GSI projects are viewed differently depending on where they are in the system. Within the CSO area, GSI projects can reduce the volume of CSO overflows or the size of CSO storage facilities.
- Kyle Dreyfuss-Wells also asked whether the City's stormwater monitoring basins contain any stormwater treatment BMPs that could reduce pollutant concentrations in the samples.
  - Kevin Buckley of SPU replied that the monitored basins have minimal BMPs.
- Bob Pitt suggested that it would be important to know where the potential deferred CSO projects are, and how that relates to where benefits might be gained through stormwater projects. Derek Booth expressed doubt about whether regulators would see a pound of pollutant reduced in Pipers Creek as equivalent to a pound of pollutant reduced in Lake Washington, even though the Consent Decree is not explicit on this issue.
- Bob Pitt, Bob Gearheart, and Derek Booth commented on the high proportions of groundwater shown in the delineation of flow source areas for CSO basins.
  - Ed Mirabella of SPU noted that the "groundwater" included inflow and infiltration (I&I), and the numbers were from CSO events.
  - Bob Pitt said that the numbers imply that SPU needs to do more than just address surface water, including I&I reduction efforts. He also asked whether there was any way to validate the constituents in the groundwater.
  - Derek Booth recommended comparing the modeled groundwater flows for the CSO basins to the groundwater table.

<u>Comments on Proposed Process for Evaluating Projects:</u>

- Bob Pitt noted that a potential problem with nomographs is that they assume a certain device. It is therefore important to include a step to verify that the device fits within the range of data.
  - SPU and the technical team agree with the comment. Nomographs can be very general or made more site- and device-specific. The team will make sure that either the nomographs are specific to the performance range for a site or will be verified afterwards if a more general nomograph has been used.
- Bob Pitt said that SPU has an opportunity to reduce uncertainty by incorporating water quality monitoring into projects so that SPU can evaluate whether the projects achieve their expected benefits. He also observed that SPU doesn't have baseline data for the projects.

- Kevin Buckley said that SPU would be doing post-construction monitoring of the stormwater projects, as it does with CSO projects. However, he acknowledged that this monitoring is tied to the projects, not to the receiving water bodies.
- Bob Pitt suggested considering small-scale intensive demonstration projects that are monitored intensively, such as a drainage area of a watershed that is intensively retrofitted as compared to an area that is not retrofitted. Once you have confidence in the drainage area, then you may understand more about the receiving water body.

- Bob Gearheart asked whether it might be possible to focus projects in one watershed so that success could be more easily demonstrated, rather than dispersing the projects.
- Reacting to the example metric for the project evaluation, Derek Booth expressed concern that the comparison of projects could overlook ancillary benefits from projects by focusing on metrics that can be easily compared in spreadsheets. Jean Zodrow added that it would be important to tie all the benefits together and not just focus on pollutant loads.
  - Rob Annear mentioned that SPU and the technical team welcome suggestions for other ways to compare projects, such as effects on habitat.
- Bob Pitt noted that cost (capital cost, land cost, opportunity cost) is another factor that will need to be built into the decision analysis.
- Kyle Dreyfuss-Wells observed that "gray" infrastructure projects could have much greater impacts during construction compared to "green" infrastructure projects. Bob Pitt added that green infrastructure projects are also disruptive, but the disruption is often smaller and for a shorter time.
  - Ed Mirabella of SPU and Jennifer Price of CH2M HILL noted that community reactions to disruption from green and gray CSO/stormwater projects has varied in Seattle, and some neighborhoods have had more issues with green infrastructure projects than CSO storage tanks.

Receiving Water Exposure Assessment Methodology Discussion

- Rick Pleus of Intertox gave a presentation on the proposed exposure assessment for the Integrated Plan, which would look qualitatively at the hazard (toxicity) and the exposure for both human and ecological receptors.
  - This methodology can be used to compare projects, as well as to compare "before" and "after" conditions associated with projects, for the RCOCs discussed earlier.
  - While the initial approach to the Exposure Assessment methodology has been developed, SPU and the technical team will refine the methodology for the Exposure Assessment after SPU reviews the quality and quantity of the data relevant to the assessment. The key parameter at this point is the concentration of a relevant RCOC.

Expert Panel Comments and Responses

Comments on RCOCs and Data Gaps:

- Jean Zodrow observed that it seemed as though SPU did not have good data for some constituents, such as pesticides, and asked what the technical team would do in the absence of anything other than TSS to measure those constituents. Semi-volatile organic compounds (SVOCs) are another area where there may not be much data.

- Rick Pleus of Intertox clarified that the issue with pesticides was not that SPU did not have data for pesticides, but that the technical team had not identified which pesticide it would evaluate and what data are available to consider. The technical team is currently evaluating the data available. For example, it appears that two weaknesses in data quality and quantity may be PBDEs and oil/grease. He also asked whether choosing certain surrogates, such as copper for metals, would cause the team to miss anything important.
- Jean Zodrow suggested that PCBs could be a surrogate for PBDE, as those constituents may have similar behavior. For SVOCs, TSS could potentially be used. It is important to pick the right constituents to measure, since they get carried through. Rick Pleus said he understands the possible use of surrogates in the Exposure Assessment but would need to consider the data sets and constituents better to provide an opinion whether either of these is reliable.

- Bob Pitt noted that some constituents, such as copper, could be present in many types of form (complex, ionic, coil, associated with sediment, etc.). The different forms of the constituent will behave differently, and that could affect toxicity and exposures.
  - Bob Pitt asked whether SPU would use water chemistry modeling to evaluate the behavior of different speciation of constituents. Rob Annear of Geosyntec said that the technical team would be relying on receiving water and stormwater sampling data.

<u>Comments on Variations in Exposure:</u>

- In regards to Rick Pleus' question of the Expert Panel on whether acute exposures should be considered, Bob Pitt noted that acute (short exposure) issues are rare for receiving waters; chronic issues, especially associated with sediment, are much more common. Chronic exposure to fecal coliform can lead to regrowth in streams, for example.
- Jean Zodrow said that there are acute issues associated with the first stormwater event. For example, there is the potential for fish to be exposed to dissolved copper, which is what the National Marine Fisheries Service focuses on.
  - Bob Pitt observed that it would be important not to oversimplify the answer, given the complexity of the exposures.
  - Mike Milne of Brown and Caldwell added that the key is not to introduce any bias when comparing projects.
- Kyle Dreyfuss-Wells observed that it would be useful to know what happens to the first flush of stormwater for evaluating effects on exposures. She added that it is important to consider how projects affect exposure in the context of how the overall system is operating.
  - Eric Strecker noted that sediments are often more suspended in CSO areas.
  - Bob Pitt said that volume reduction and maximizing the flows that go to the treatment plant are important strategies.
- Bob Gearheart asked how the technical team would evaluate temporal effects.
  - Rick Pleus of Intertox said that the technical team would review on a case-by-case basis whether it would be useful to get more detail for a given parameter for the Exposure Assessment (e.g., season, duration, etc.).

Bringing It All Together: Reflections on the Proposed Methods and Data Sources

- At this point in the meeting, the Expert Panel was asked for overall impressions and reflections on the proposed methodology and the data that SPU plans to use for the evaluation. Reflections included the following:
  - Bob Gearheart said that the momentum of the project seems to be on the right track.
  - Jean Zodrow said she believed that things were on the right track, except for minor details.
  - Derek Booth commented on the difference between the complexity of understanding the behavior of constituents and their effects on exposure on the one hand and the simplicity of the exposure assessment tools being proposed to evaluate them on the other hand. He did not have suggestions for the exposure assessment methodology, but expressed doubts that it would be adequate.
    - Eric Strecker noted that SPU only needs to compare projects, as opposed to show what the exposure is.
  - Bob Pitt commented that he was astonished by the rapid time frame in which this is being done, and the limited time for evaluation. He noted that it is critical that SPU will be able to verify its efforts, and suggested reserving a fraction of the money for projects for verification.
    - Mike Milne of Brown and Caldwell said that there may be ways to address uncertainties based on how projects are combined into alternatives and selected.
  - Kyle Dreyfuss-Wells said that overall this is a good idea, and that the "perfect can be the enemy of the good." She expressed concern that stormwater projects are not getting adequate consideration as compared to CSO projects.
    - Bob Pitt added that we should not need a different standard for comparison.

Overview of the Multi-Objective Decision Analysis (MODA) Process

- Emiko Takahashi of SPU presented on SPU's use of MODA, covering:
  - When and why SPU uses MODA
  - A car example showing different elements of MODA process—the criteria, measurement scale, and weighting of social and environmental criteria, and then comparing those benefits or values to the costs of the options
  - An example of MODA applied to stormwater projects from Bob Pitt's paper, with the key difference in SPU's analysis that costs were analyzed separately from other criteria
  - Categories of draft MODA criteria SPU is considering for the Integrated Plan
- She noted that MODA will be used to evaluate CSO and stormwater projects individually, and then to compare CSO and stormwater projects. The MODA doesn't make the decisions, but helps inform the decisions.
- In June, SPU will present draft technical criteria for the MODA evaluation for the Expert Panel to review and comment on.

Expert Panel Comments and Responses

- Derek Booth asked how SPU would use MODA to choose projects when there is a hard decision—that is, there are no obvious choices (high value/low cost) that emerge.

  - Emiko Takahashi said that one way to help with those situations is to reconsider the weights for the criteria.
  - Bob Pitt said that external constraints, such as budget, also influence the decision.
- Bob Gearheart said that the transparency of the weighting is critical. He also asked how the weighting would be done.
  - Emiko Takahashi replied that SPU would have a diverse staff group do the weighting, and then would conduct sensitivity analyses of the results.
- Bob Pitt suggested incorporating dollars per pound into the analysis, rather than evaluating cost separately.
- Derek Booth said that an important weighting is the "fatal flaw weighting"—how SPU decided which projects would be considered for the Integrated Plan. The Expert Panel needs to know what criteria were used to determine whether projects were fatal flaws. People have different opinions of what makes something a fatal flaw.
  - Emiko Takahashi said that one fatal flaw criterion was whether SPU could fund the project.
- Derek Booth and Kyle Dreyfuss-Wells discussed the potential criterion for leveraged funding. Derek Booth noted that leveraged funding could be double counted since cost is considered elsewhere in the MODA; instead of including it as a social/environmental value, the cost with leveraged funding could be plotted as another point on the cost chart. Kyle Dreyfuss-Wells said that this criterion should not be overlooked, but agreed it could be handled that way.
- Several Expert Panel members commented that may have advice relevant to the non-environmental criteria for the MODA and could offer comments, even though they may not be "experts" on those topics.

Observer Comments

- Rachel McCrea of the Washington State Department of Ecology said that some of the comments expressed at the meeting resonated with her, but she had no further comments at this time.
- Jennifer Price of CH2M HILL noted that she was attending the meeting as an observer for the City of Spokane, which is evaluating similar issues, but not within the context of a consent decree. She is interested in identifying a methodology that could be replicated that is not too cost prohibitive or complicated.

Wrap Up and Next Steps

- Trish Rhay of SPU thanked Expert Panel members for their participation, and said that SPU's challenge is to have solid enough data to tell a reasonable story and have enough time to get the analysis done.
- Bob Gearheart acknowledged his appreciation for the staff work supporting the Integrated Plan thus far, and noted that engineers need to make decisions with less data than this all of the time.
- Bill Ross of Ross Strategic added that SPU will need to make a reasoned judgment comparing stormwater and CSO projects based on available data, without understanding everything that may be occurring in the landscape and water bodies.
- Next steps identified at the meeting included:

- The **next Expert Panel meeting** will be on **Tuesday, June 25, 2013,** in Seattle. It will focus on the technical criteria for the MODA evaluation.
- Kevin Buckley of SPU said that he will brief SPU management on this meeting, and will meet with the technical team to discuss how to respond to the Expert Panel's suggestions. Information on the technical team's proposed responses will be distributed to the panel.

Participants and Observers

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Derek Booth	Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
Jean Zodrow	Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO
SPU and Consultant Participants at the Table	
Kevin Buckley	Integrated Plan Project Manager, SPU
Ray Hoffman	Director, SPU
Trish Rhay	Drainage and Wastewater Division Director, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic
Audience Members	
Nancy Ahern	SPU
Maythia Airhart	SPU
Martin Baker	SPU
Shelly Basketfield	SPU
Andy Chittick	SPU
Rex Davis	SPU
Pam Emerson	SPU
Jonathan Frodge	SPU
Ed Mirabella	SPU
Charles Oppelt	SPU
Beth Schmoyer	SPU
Tracy Tackett	SPU
Emiko Takahashi	SPU
Ingrid Wertz	SPU
Justin Twenter	Brown and Caldwell
Jennifer Price	CH2M HILL
Molly Adolfson	ESA
Rob Annear	Geosyntec Consultants
Eric Strecker	Geosyntec Consultants

Name	Organization
Rick Pleus	Intertox
Jennifer Tice	Ross Strategic
Rachel McCrea	Washington State Department of Ecology

Seattle Public Utilities Integrated Plan Expert Panel
Meeting #3, June 25, 2013
Meeting Summary

Participants

The third meeting of Seattle Public Utilities (SPU) Integrated Plan Expert Panel was attended by the five Expert Panel members, SPU managers and staff, consultants, and observers. The audience consisted largely of SPU staff and technical consultants. A full list of attendees is at the end of the summary.

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Derek Booth	Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
Jean Zodrow	Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO
SPU and Consultant Participants at the Table	
Kevin Buckley	Integrated Plan Project Manager, SPU
Andrew Lee	Combined Sewer Overflow Program Manager, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic

Meeting Objectives

The objectives for the Expert Panel meeting included:

- Review the overall flow of the decision-making framework for the Integrated Plan, including the purpose and role of multi-objective decision analysis (MODA) in that context.
- Review and collect Expert Panel member feedback on changes to the methodology for evaluating combined sewer overflow (CSO) and stormwater projects, including the pollutant load estimation methodology and the exposure assessment methodology.
- Present and obtain Expert Panel feedback on the proposed evaluation criteria and scales for the MODA.
- Review example projects, which have been previously implemented by SPU and which have been evaluated using the proposed MODA criteria, and discuss the process for ranking projects and evaluating benefits and costs.
- Review upcoming meeting plans and identify next steps.

A summary of the meeting discussions, organized by the agenda topic, is below. Key themes from the meeting are not attributed to individuals, but comments pertaining to individual sessions are attributed.

Summary

Opening Remarks

- Bill Ross of Ross Strategic welcomed participants to the meeting, reviewed the agenda, and noted that SPU's decision-making for the Integrated Plan will proceed soon after the Expert Panel's final meeting in September. He said that the Expert Panel's contributions to SPU's decision-making are recorded in the summaries of the Expert Panel meetings.

Key Themes from the Expert Panel's Comments

Throughout the meeting, Expert Panel members commented on SPU's proposed methodology for assessing exposure and evaluating pollutant loads from stormwater and CSO projects, and how SPU plans to use multi-objective decision analysis (MODA) to support its decision-making. The following were key themes from these comments and notes about SPU's responses (individual comments and responses are also included later in the summary):

- By focusing on concentrations, the proposed exposure assessment methodology ignores important considerations. SPU should add mass loadings to its formula for exposure index values (EIVs), so that mass, volume, frequency, timing, and concentration are considered in some way when evaluating exposure reductions from stormwater and CSO projects.
  - SPU Response: The Integrated Plan team has considered adding these factors to the EIV calculations, but has not finalized the algorithms to account for mass, volume, and timing of discharge. These algorithms will be developed during the next phase of the project. The intention is to have this work completed by the August conference call with the Panel.
- It is important for SPU to consider not only the relative change in exposure or loads, but also the value or utility of that change. Changes that occur near regulatory thresholds or levels associated with human health or ecological effects should be valued differently than changes that do not occur near these levels. Incorporating utility curves is one way that SPU could address this concern.
  - SPU Response: Following the June 25th Panel meeting, the Integrated Plan team considered the recommendation to use utility curves for evaluation of changes in the loads and concentrations associated with stormwater and CSO projects. The team acknowledged that utility curves could be a useful tool to help determine which stormwater projects provide significant benefit over CSO projects but decided that utility curves would not be used as part of the pollutant reduction methodology or MODA. This decision was based upon the reality that the consent decree does not require Seattle to meet a standard or target, only show a significant benefit of stormwater projects over CSO projects and that total maximum daily loads (TMDLs) have not been established for most of the consent decree constituents in our receiving water bodies; therefore, SPU does not have waste load or load allocations that could serve as benchmarks for the Integrated Plan project load reductions. Furthermore, the information required to make such an assessment cannot be generated given the available time and data for this project.

Because of these factors the team did not want to create a benchmark or target for use with the utility curves as suggested by the Panel.

- SPU should focus its analytic attention for the Integrated Plan first and foremost on meeting the consent decree requirements of showing that the proposed stormwater projects provide significantly better water quality benefits than the CSO projects proposed to be deferred. MODA is a useful second step for adding transparency to SPU's decision-making process; however, it does not warrant as much attention from the Expert Panel.
  - SPU Response: SPU and the Integrated Plan team remain committed to demonstrating the requirements of the consent decree with the Integrated Plan. Based on the Expert Panel's comments, SPU has revised plans for the final meeting of the Expert Panel in September and added a conference call in August to reflect this focus and the interests of the Panel. SPU also will be simplifying its process by conducting MODA only on options (combinations of proposed stormwater projects and CSO projects to be deferred) and not first conducting MODA on individual stormwater and CSO projects. For all of the options, SPU will demonstrate the consent decree requirements that the proposed stormwater projects provide greater water quality benefits than the CSO projects proposed for deferral.
- Since monetization cannot be done uniformly and consistently across the MODA criteria, the Expert Panel thought that this would not be a particularly useful investment of SPU time and resources.
  - SPU Response: After considering the Expert Panel's advice, SPU has decided not to monetize the MODA criteria for evaluating Integrated Plan projects. The Integrated Plan team will, however, quantify the benefits or impacts from projects where possible (e.g., CO_2 reductions).
- Expert Panel members commented on the difficulty of providing input on SPU's methodology in the abstract, particularly for the exposure assessment, and said that it would be helpful to see more of the analyses conducted by the SPU and the Integrated Plan team. For example, some of the potential issues the Panel raised included addressing data with significant amounts of non-detect values, using linear scales to represent non-linear data, considering results that are very similar (e.g., after normalization), and combining exposure scores from different pollutants or receptors.
  - SPU Response: There will be an Expert Panel conference call scheduled in August during which the Integrated Plan team will review its analyses for the exposure assessment and the assessment of water quality impacts of projects. This will allow the team to follow up on the potential issues the Panel identified.
- Expert Panel members had differing views regarding the complexity of SPU's analysis. On the one hand, Panel members noted the importance of avoiding over-simplification of analytic results, such as by summing all exposure index values or by reducing MODA results to a single score by normalizing, scaling, and averaging. They noted it is important for staff and decision-makers to understand the factors contributing to aggregate scores (effects of projects on individual pollutant loads, sensitivity analysis of how different MODA criteria affect the value scores, etc.). On the other hand, Panel members noted that it would also be important for SPU to avoid overcomplicating the analysis to demonstrate the consent decree requirements, particularly since this Integrated Plan could inform similar plans that other utilities develop across the country.

- SPU Response: Based on concerns about complexity and the importance of demonstrating the consent decree requirements, SPU is creating a more distinct divide between the first phase of its analysis, which focuses on demonstrating that proposed stormwater projects have significantly greater water quality benefits than the CSO projects to be deferred, and later stages of its decision-making, which include MODA and consideration of other decision factors. SPU will only evaluate options in MODA that meet the consent decree water quality requirements. SPU will also keep in mind the importance of providing relevant information to decision-makers based on SPU and team's analysis of exposures, pollutant loads, and other criteria.

Review of Integrated Plan Decision-Making Framework

- Emiko Takahashi and Kevin Buckley of SPU described the overall decision-making framework for the Integrated Plan, which includes four parts:
  - Evaluation of projects based on consent decree requirements (pollutant loads and exposure assessment) and other evaluation criteria relevant to SPU's decision-making
  - MODA on *individual* stormwater and CSO projects (Note: Following the meeting, SPU decided to skip this step in its process.)
  - MODA on Integrated Plan *options*—combinations of stormwater projects to be implemented and CSO projects to be deferred (all options must meet the consent decree requirement that proposed stormwater projects "will result in significant benefits to water quality beyond those that would be achieved by implementation of the approved CSO Controls Measures only")
  - Other decision factors (e.g., scheduling and financing)
- Emiko Takahashi added that MODA is used extensively at SPU to transparently consider potentially competing objectives in its decisions. SPU also intends to use MODA to satisfy the cost-benefit analysis requirements of the consent decree.
- Kevin Buckley said Integrated Plan options, all of which will have been analyzed as described above, will be presented to the public in the Environmental Impact Statement (EIS); one option will then be recommended to SPU management and included as the Integrated Plan option for the Long Term Control Plan (LTCP).

Expert Panel Comments and Responses

- Kyle Dreyfuss-Wells asked SPU to comment on SPU potentially using receiving waters with deferred CSO projects as a factor for selecting Integrated Plan options.
  - Kevin Buckley of SPU said the consent decree does not require SPU to consider the locations of the receiving water bodies for the stormwater projects and CSO projects to be deferred in the Integrated Plan, but SPU could consider this. In response to a question, he said the issue of deferring a CSO project in one location but getting the benefit in another location has not come up in public meetings, because the CSO projects SPU plans to defer are low priority.
  - Bob Gearheart asked whether this factor was implied by the performance standard for projects to meet water quality standards. Kevin Buckley responded that the consent decree requires comparing the pollutant load reductions and the relative water quality benefits of Integrated Plan projects. (This is a relative comparison of project impacts, rather than an evaluation of water quality standards attainment.)

- Bob Pitt recommended that SPU and the technical team avoid the terminology "deferred CSO," but rather specify "deferred CSO projects" to avoid confusion.

Exposure Assessment Methodology Discussion

- Rick Pleus of Intertox gave a presentation on the proposed exposure assessment methodology; his presentation covered the following topics:
  - The consent decree requirements for assessing reductions in pollutant exposure for human and ecological receptors
  - The use of relative, not absolute, estimates of exposure and hazard for the exposure assessment
  - The Integrated Plan team's progress to date in developing the exposure assessment methodology, including conducting site visits and identifying receptors
  - The equations fundamental to the exposure assessment, including Exposure Index Values (EIVs) and receptor factors
  - Steps in the exposure assessment to identify the components of the EIV equation (pre- and post-project concentrations, target concentrations, and receptor factors), calculate the EIVs, and sum and normalize the EIVs for human and ecological factors for each project
  - Remaining work to complete, including considering frequency, volume, and time in the algorithm
- In answer to questions from the Expert Panel, Rick Pleus clarified that the team visited sites that it thought would provide the best information about the different site types, rather than all of the project sites, and that the target values for water quality or human health are typically not mandates (e.g., they might be a reference dose for human health). He also noted that the EIVs for human and ecological receptors would not be combined, but would remain separate.

Expert Panel Comments and Responses

- Derek Booth and Bob Pitt commented on the fact that relying exclusively on comparisons of relative risk might not allow differentiation between cases where a very small risk is reduced and where a large risk is reduced.
  - Rick Pleus said that the Integrated Plan team will prioritize the biggest drivers of risk, based on 20 years of professional experience.
  - Based on this information that the team will consider other information, Bob Pitt said that he would have concerns if the team shared the same slides with the public since they are overly extreme about the use of relative risk and could cause the team to have to backtrack.
- Jean Zodrow asked the team about how sensitivity would be considered for threatened and endangered species, and whether it would consider species distribution.
  - Gretchen Bruce of Intertox said that they would be considering the age, life stage, and the threatened and endangered status of species, but it would not be worth the effort to consider species distribution for this analysis.
- Bob Pitt recommended that the Integrated Plan team adjust the formula for EIVs so that it considers volume and mass discharge, not simply concentration. He noted that target concentrations do not mean much for stormwater projects; the important factors are sediment and volume reduction. Groundwater contamination and the fate of groundwater is another consideration. He said that if

the TMDL requirement for the water body were based on exposure, the TMDL could be used as the target in the EIV. To avoid double counting (since concentration is based on mass over volume), Dr. Pitt recommended that the EIV be revised so that it examined the change in mass over the TMDL target value as well as the post-project concentration.
    - Rick Pleus noted that the TMDL is based on the entire reach or stream, and doesn't have the same nuances for assessing exposure. Bob Pitt responded that TMDL values could be assigned to locations. SPU staff also noted that TMDLs have not been established for most of the consent decree constituents in Seattle's receiving water bodies.
    - Jean Zodrow commented that this conversation omitted an important factor in the EIV equation—the receptor factor. If the receptor factor were 1 in a high-quality stream versus 0.5 in a degraded area, this would have a large effect on the final result. Rick Pleus agreed and pointed out the receptor factor in the newest version of the EIV algorithm.
- Derek Booth commented that the EIV formula captures the magnitude of the change, but not the value of the change. He said that may not be particularly useful. To illustrate his point, he provided an example of two projects that would produce the same results, even though one project would meet the target concentration (Case 1: 10-9 = 1; Case 2: 2-1 = 1 and meet target concentration).
    - Rick Pleus mentioned that, while he understood the point, it is important to remember that the consent decree emphasizes establishing the "benefit" of one project over another project, but that there is no requirement to meet some standard such as a water quality guideline. Furthermore, the data might not be sufficient to make an accurate prediction of the post-project concentration with any degree of certainty.
- Bob Pitt suggested that the Integrated Plan team consider the utility function in the exposure assessment. The utility function examines the overall utility or value of changes in a parameter. It would, for example, help SPU and the Integrated Plan team to assess how much more one concentration was worth than another (e.g., if the concentrations are well above the goal, changes do not matter as much). The paper Dr. Pitt circulated to SPU and the Panel previously describes the concept of utility function.
    - Gretchen Bruce of Intertox said that the team would be looking at the change in concentrations in the exposure assessment, but not the value of the change. Rick Pleus added that the team is not doing a full exposure assessment.
    - As noted in the summary of themes above, since the meeting, the Integrated Plan team reviewed the recommendation to use utility curves and concluded that the concept would be difficult to apply here since the consent decree does not require Seattle to meet a standard or target (it only requires that SPU show a significant benefit of stormwater projects over deferred CSO projects), and TMDLs have not been established for most of the consent decree constituents in receiving water bodies for Seattle's discharges. Thus benchmarks are not available to apply to the utility curves.
- Reflecting on the site photos, Expert Panel members commented on how public uses would be considered in the exposure assessment. Bob Pitt noted that it would be important to look not just at the site, but also in the vicinity of the site to identify swimming beaches, parks, and other nearby

public use areas. Kyle Dreyfuss-Wells said that the most important factor is whether the overflow is in a public beach or in a hidden or inaccessible area.

- Mike Milne of Brown and Caldwell and Rick Pleus of Intertox concurred with the comments about the importance of considering public uses and indicated that the team will incorporate information on locations of nearby beaches, parks, tribal fishing areas, and public access points. The EIV considers, for example, the distance to locations of public use from a given outfall. Several Expert Panel members commented that it would be useful to see numerical examples to better understand and comment on how the exposure assessment calculations would work.
  - The Integrated Plan team concurred and will generate data to input into the draft EIV algorithms. Given no unforeseen obstacles, these data will be available for the Expert Panel to review at a conference call in August.
- Bob Pitt and Derek Booth observed that treating the data linearly by normalizing the data could present some problems. For example, there may be a lot of low values in the results, and normalizing them could make them artificially high. Another outcome could be that the normalization will produce very similar results that are not very meaningful. Examining how the data are clustering could help as well as considering utility (as described earlier).
  - Integrated Plan team members acknowledged the Panel's potential concerns with normalization. Both the Integrated Plan team and Panel members noted that examining actual output data will allow appropriate assessments of how to normalize data..

Observer Comments and Responses

- Mark Henley of the Washington State Department of Ecology (Ecology) asked how the exposure assessment would consider impaired water bodies and those listed under section 303(d) of the Clean Water Act.
  - Mike Milne of Brown and Caldwell, Kevin Buckley of SPU, and Eric Strecker of Geosyntec identified several places in the Integrated Plan team's analysis where regulatory status has been or would be considered, as follows.
    - SPU considered impaired water bodies when it prioritized water bodies where candidate stormwater projects would be identified.
    - The numerical values in the EIVs (e.g., target concentration) relate to regulatory requirements.
    - When SPU forms "options" of stormwater projects to implement and CSO projects to defer, it will consider the offset in the receiving water body.
    - In SPU's MODA analysis, there is an opportunity to consider regulatory status (impaired water body, recontamination of Superfund site, etc.).
- Mark Henley commented that he did not want the Integrated Plan to undermine the overall value of achieving CSO control and that it should provide a fair and balanced evaluation of CSO project water quality benefits, particularly since SPU's Integrated Plan may serve as a national model for these plans. It should be clear that in the Integrated Plan SPU is looking at low-priority CSO projects that address CSOs that are almost under control, and that SPU does not plan to defer other CSO projects that have more benefits.

- Bill Ross of Ross Strategic said that the Integrated Plan would be examining the benefit of the deferred CSO projects if implemented (controlling the outfalls to one overflow per year) and the benefit of the stormwater projects if implemented.
- Andrew Lee of SPU said that this issue was largely one of messaging for the Integrated Plan. SPU will state that it is looking at a certain set of projects for the Integrated Plan; the agency will not be claiming that all stormwater projects are better than all CSO projects.

- Mark Henley observed that the range of values in the receptor factor equation was 1 to 5 for the likelihood of exposure, but 1 to 15 for magnitude of exposure.
  - Gretchen Bruce of Intertox said that the basis of the 1-15 range is data compiled by EPA on relative exposure levels associated with different scenarios (e.g., skin surface area exposed to water during swimming or wading, incidental water ingestion rates during recreational activities, or fish and shellfish consumption). The team will provide documentation for the approach.

Updates to the Pollutant Load Estimation Methodology for Stormwater Projects

- Rob Annear of Geosyntec presented updates to the methodology for estimating pollutant load reductions from stormwater projects. His presentation included:
  - The current list of representative constituents of concern (RCOCs), including changes from the potential RCOCs identified at the April Expert Panel meeting
  - The status of the stormwater project analysis
  - Examples of the box plots of the pollutant load data the team is examining for commercial, residential, and industrial sites
  - Recommended project comparison metrics to meet the consent decree requirements (including water quality impacts and exposure assessment) and inform SPU's MODA
  - Proposed methodology for characterizing baseline conditions and estimating pollutant loadings from stormwater projects

Expert Panel Comments and Responses

Comments on RCOCs and the Available Data:

- Jean Zodrow asked why zinc was added as a constituent of concern.
  - Beth Schmoyer of SPU said that SPU added zinc because it is a specific benchmark for industrial stormwater permits that facilities often struggle with. SPU plans to look at both copper and zinc.
- For the proposal to assess PBDEs using total suspended solids (TSS), Jean Zodrow mentioned Sandy O'Neill's study of pollutant loads and cycling through biological organisms in Puget Sound, although Ms. Zodrow wasn't sure whether the study specifically considered PBDEs.
  - Members of the technical team said that they would examine that resource.
- Bob Pitt questioned the decision to use BOD/TSS as an RCOC for pH, if pH were specifically listed in the consent decree. He said that reduced concentrations result in subtle changes in pH. Rob Annear of Geosyntec said that the team can discuss the approach to pH at a future Expert Panel meeting.
- Panel members made several suggestions related to the presentation of the data, as follows.
  - Bob Pitt suggested adding the numbers of observations to the box plot charts.
  - He also suggested presenting the data with a truncated probability distribution, or plotting the data based on percent detected.

- Some Panel members noted that the Y axis was different in the slides, but should be consistent in future presentations.
- Eric Strecker of Geosyntec said the team would be increasing the font size for the charts.

- Several Panel members commented on the differences between the data for different site types, and noted that land use categories such as industrial can vary significantly. There are highly site specific reasons why the data may differ, such as roof runoff and urban wildlife in forested areas. In addition, Bob Pitt noted that seasonality is important, due to inputs to the land.
- Bob Pitt and Derek Booth commented that for some pollutants, there may be a significant amount of data that are below or very close to detection levels (practical quantification levels). Furthermore, they noted that scaling data containing a large amount of non-detected values could skew the overall results. (The suggestions above for indicating the number of observations in charts and presenting data with truncated probability distributions could help address issues with non-detects.) For the PCBs, in particular, Bob Pitt said that detection limits will be critical.

Comments on the Stormwater Project Analysis:

- Kyle Dreyfuss-Wells commented on the fact that only two metrics were proposed as inputs to MODA, when there were many other metrics proposed for comparing stormwater and CSO projects. Bob Pitt added that concentrations and loads could be considered separately in MODA.
  - Kevin Buckley of SPU indicated that SPU had not yet fully determined how water quality would be considered in MODA.
- Bob Pitt asked whether SPU would be conducting demonstration projects to supplement the performance data, or will it directly implement full-scale projects.
  - Andrew Lee of SPU said SPU would consider demonstration projects on a case-by-case basis.
- Bob Pitt added that there is more uncertainty on some projects than others, and recommended that SPU conduct mass-balance analysis to determine if anything looks odd. He noted that the performance of sweet sweeping, in particular, should be verified.
  - Eric Strecker of Geosyntec noted that the consent decree requires post-construction monitoring.
- In response to a question from Bob Gearheart, Rob Annear clarified that the team will apply the model to the catchments, but does not plan to include other subcatchments that feed into them.

Observer Comments and Responses

- Mark Henley of Ecology asked how the technical team would compare the reductions in fecal coliform loads from stormwater projects to those that come from eliminating CSOs. He indicated that the stormwater projects would have to reduce fecal coliform levels significantly to be comparable to the benefit from reducing CSOs.
  - Bob Pitt commented that there are highly site specific reasons why some sites have high fecal coliform levels. Jonathan Frodge of SPU said that some of the numbers may be correlated with homeless encampments in the vicinity of the sites.
- Beth Schmoyer of SPU expressed concern about the technical team's proposal to use bis(2-ethylhexyl)phthalate as the RCOC for semi-volatile organic compounds (SVOCs). She noted that bis(2-ethylhexyl)phthalate is everywhere (including lab contamination) and is not very toxic to humans. Other contaminants are more differentiated. Bob Pitt suggested that including the frequency of detection as a measure would help.

- Beth Schmoyer and Rob Annear discussed the use of use bis(2-ethylhexyl)phthalate as the RCOC for SVOCs following the meeting and determined that given the available data, the use of use bis(2-ethylhexyl)phthalate as the RCOC for SVOCs would be acceptable.

Updates to the Pollutant Load Estimation Methodology for CSO Projects

- Justin Twenter of Brown and Caldwell provided an update on the Integrated Plan team's methodology for evaluating pollutant loads from the 10 candidate CSO projects that could be deferred.
  - The team's proposed approach is to use simulated flow from models, and to pool city-wide sampling data and use average values for each of the residential and commercial sites.
  - The team will also be using sampling data from a King County industrial site.

Expert Panel Comments and Responses

- Kyle Dreyfuss-Wells commented that in the consent decree it seems like fecal coliform is treated as equal to other pollutants, yet she believes that people would not tolerate having significant fecal coliform remaining in either CSO overflows or stormwater discharges. You do not want raw sewage in the water. Not all pollutants are created equal; a project could do a "rock star" job on some contaminants, but not as well on others.
  - Jonathan Frodge of SPU said that the city's CSOs primarily occur in the winter, so fecal coliform levels are not necessarily the biggest concern from an actual exposure point of view.
  - Bob Pitt commented that 10,000 CFU/100 mL is not unusual for stormwater discharges, and that it is difficult to get below 400 CFU/100 mL. He said that regrowth and initial die off of bacteria are complicating factors. Classical modeling only looks at the first phase.
  - Mark Henley of Ecology said that the pollutants are treated equally in terms of having water quality standards that are appropriate for each pollutant and which must be met by any discharges.

Observer Comments and Responses

- Beth Schmoyer of SPU questioned whether the SPU sites were a mixture of industrial and non-industrial land uses, and proposed to discuss this outside of the meeting with the consultant team.
- In answer to a question from Mark Henley of Ecology regarding the fact that some years there might not be any CSO discharges, Justin Twenter said that the team would be looking at an average of 30 years when evaluating whether the CSO is controlled to an average of one overflow per year. Justin Twenter added that the team will examine seasonal loadings as well as the frequency of discharge.

Discussion of the Proposed MODA Criteria, Scales, and Process

- Dan Pitzler of CH2M HILL reviewed the criteria and scales that SPU and the Integrated Plan team have developed for the multi-objective decision analysis (MODA) that SPU will conduct for the Integrated Plan, although noted that the team is still working on water quality criteria, which could consider a variety of subfactors.
  - The criteria reflect the City's goals and are intended to give insight into what SPU feels is important for its decision.
  - All projects evaluated in MODA will meet the consent decree requirements for water quality.

- Many of the scales are constructed to be on a 1-5 scale, with 5 being the best.

- In response to a question from the Expert Panel, Dan Pitzler clarified that carbon dioxide, which has a direct measure, will be normalized to a 0-1 scale and criteria will be measured on a qualitative 1-5 scale.
- Kevin Buckley of SPU reviewed five example stormwater and CSO projects that either have been or are about to be built. SPU and consultant staff scored these projects using the MODA criteria proposed for Integrated Plan.
- After reviewing the MODA criteria and scales with the Panel, Dan Pitzler described the steps in the MODA process, and showed the results of the analysis for the example projects. He described how SPU would plot the value scores for projects against the costs, conduct a sensitivity analysis of the weights, and then look at a graph of cumulative cost to cumulative value to identify the "knee of the curve." Finally, Mr. Pitzler said that a team is examining which of the MODA criteria can be monetized, and that SPU plans to conduct MODA both with and without monetized information.
- As part of this discussion, Emiko Takahashi of SPU and Dan Pitzler of CH2M HILL reviewed the steps in the overall Integrated Plan decision-making process, including the use of MODA on options or packages of stormwater and CSO projects, and other decision factors considered after MODA.
  - Ms. Takahashi noted that other factors SPU may consider in developing the options or later in its decision-making process include matching the locations of stormwater and deferred CSO projects, an emphasis on pedestrian/green grid, whether SPU has the money and ability to implement the projects, and for joint projects with King County, whether King County would be ready to implement the projects within the required schedule.

Expert Panel Comments and Responses

Comments on the MODA Criteria and Scales:

- Kyle Dreyfuss-Wells asked where in the MODA criteria would the tradeoff between capital and operations and maintenance (O&M) costs be considered. She noted that from an organizational standpoint, it is often easier to fund capital projects than projects that have high O&M costs.
  - Andrew Lee of SPU said that the City looks at total lifecycle costs, and does not differentiate between capital and O&M costs.
- Bob Pitt asked why energy use was not considered, and recommended that SPU document the methods it would be using to quantify impacts. Dan Pitzler of CH2M HILL said that the team thought that energy use would be captured by other factors, including CO_2 emissions.
- There was considerable discussion among Expert Panel members and observers about the environmental criteria for MODA, the importance of water quality, and the relationship of the consent decree requirements and MODA.
  - There was initially confusion about how the MODA water quality criteria differed from the consent decree requirements. The Integrated Plan team clarified that the water quality criteria in MODA represents incremental water quality benefit beyond consent decree requirements. To meet the requirements of the consent decree, SPU will be showing that the stormwater projects proposed to be implemented will have significantly better water quality benefits than the CSO projects that are proposed for deferral.

- Bob Pitt suggested that the MODA criteria for water quality consider concentration, volume, and mass loading, since the regulations deal with different issues, and MODA would allow each factor to be considered as specifically as desired. He also said that SPU shouldn't combine pollutants.
- Kyle Dreyfuss-Wells suggested that a simpler way to do the water quality analysis in MODA would be to filter out any projects that do not meet water quality requirements.
    - Bill Ross of Ross Strategic noted that stormwater projects do not have numerical standards that they need to meet, unlike CSO projects, which have the one overflow per year standard.
    - Beth Schmoyer of SPU said a concern with removing the water quality component from MODA is that there are different ways that projects could be "better" in terms of water quality, such as volume reductions, load reductions, and effects on regulatory requirements.

<u>Comments on the Example Projects:</u>

- Bob Pitt commented that combinations of projects should be considered to meet water quality standards rather than individual control measures. For example, a smaller tank might be needed for CSO control in an area that also has green infrastructure.
    - Andrew Lee and Emiko Takahashi of SPU said that SPU looked at combinations of options to address the problems, even though they are not represented in the example projects. Bob Pitt said that does not detract from the method, but it should be documented that other projects were considered.
- Bob Pitt also recommended that the example projects be described by their control measure (e.g., wet pond) and then indicate that they were demonstrated with specific locations.
    - Rob Annear of Geosyntec and Dan Pitzler of CH2M HILL clarified that the projects are site specific and represent specific solutions to specific problems. The projects are being compared because SPU may have a certain amount of money and is deciding which projects to fund.

<u>Comments on the Monetization of MODA Criteria:</u>

- Derek Booth recommended that if SPU cannot uniformly and consistently monetize the MODA criteria, it should stop pursuing it. The criterion of whether to monetize—whether it is feasible—is arbitrary to the decision-making. He noted that once you have two ways to look at something, it is human nature to make them equivalent. The monetization does not consider water quality, among other criteria, and should not be considered side-by-side to the other method of evaluation, especially if the monetization is incomplete across all MODA factors.
    - Andrew Lee and Emiko Takahaski of SPU noted that they understood the skepticism about the monetization, and that SPU will keep in mind the Panel's comments that its methodology for the Integrated Plan could a set a national precedent.
    - Based on the advice of the Panel, SPU has decided not to monetize the MODA criteria, but will quantify the impacts of projects where possible to support its decision-making process.
- Bob Pitt commented that he could appreciate the value of monetization for explaining decisions to ratepayers, but he was less sure whether it would be of value to regulators. The important information is the quantification of the impacts (e.g., CO_2 emissions); monetization could be problematic when comparing monetary values of dissimilar items (e.g., CO_2 emissions and lost parking spaces).
    - Kyle Dreyfuss-Wells said that her utility (Northeast Ohio Regional Sewer District in Cleveland) did monetize the benefits of CSO controls, even though it was not required. She said this was

very useful in the utility's consent decree negotiations with regulators. For example, their tunnel project had a larger carbon impact as compared to green projects.
    - Mark Henley of Ecology said the consent decree does not require monetization. He advised being careful with how monetization is done, and that monetization is not accurate unless it is complete. For example, he said that all emissions would need to be considered for street sweeping projects.

Comments on the Application of MODA and the Team's Overall Methodology:

- Derek Booth expressed concern about the Integrated Plan team's methodologies (including MODA) that represent very complicated issues as a single number, commenting that they are "reductionist" approaches that obscure the impact of each individual factor in the decision-making. He recommended that more nuances of the MODA results be carried forward when SPU presents the information to decision-makers (e.g., the bar graph showing scores for the criteria, not simply the total MODA score), and noted that the sensitivity analysis would be very useful.
- Derek Booth indicated that the Integrated Plan team appeared to be spending a disproportionate level of effort in MODA, when the focus ("90-95% of the effort") should be on showing the water quality benefits of stormwater projects as compared to deferred CSO projects, although he acknowledged that this could be due to the structure of this meeting's agenda, which had reflected requests from the Panel. He added that SPU's analysis for the Integrated Plan is precedent setting, so SPU should be careful to not overly complicate things. He recommended that SPU concentrate on the analysis that shows which proposed stormwater projects "knock it out of the park" in terms of showing water quality benefits when compared to the CSO projects proposed for deferral. After that, SPU can consider other utility priorities through MODA to select which projects to implement.
- Bob Gearheart observed that MODA is important because it provides both transparency and a replicable methodology with respect to its decision-making process.

Observer Comments and Responses

- Mark Henley of Ecology said that environmental factors should be weighted highly in MODA given the focus of the consent decree and other regulations. He also observed that only select measures were proposed for evaluating environmental factors in MODA, and that others, such as carbon monoxide, were not included. Finally, he added that street sweeping would have more air emissions over the project lifetime than appears to be captured by the analysis demonstrated at this meeting.
    - Andrew Lee commented that one would have expected street sweeping to score lower in the MODA results for air quality given the emissions associated with the truck miles traveled.
    - Kyle Dreyfuss-Wells noted that there is an assumption that the projects to be proposed would meet water quality criteria; otherwise the regulators would not accept them.
- Mark Henley added that the Integrated Plan needs to show water quality benefit of stormwater projects as compared to deferred CSO projects, and that SPU will need to rationalize why CSO projects will be deferred. For example, if a CSO project is deferred and that CSO still has fecal coliform impacts, how will that key parameter be compensated?
    - Bill Ross of Ross Strategic noted that the consent decree does not specify that SPU compare pollutants on a one-by-one basis or compare impacts by receiving water body.

- After the meeting, the Integrated Plan team provided the following additional clarification: While CSOs have a spike in fecal coliform when there is a release, some of the stormwater projects may reduce fecal coliform releases during more frequent smaller storm events, leading to reduced frequency and reduced coliform counts over a year.

- Mark Henley said that the Integrated Plan is a voluntary approach, and that the deferred CSO projects will be implemented at some point in the future.
  - Jonathan Frodge noted that there is no regulatory requirement that the stormwater projects be implemented. Mark Henley clarified that there could be requirements in MS4 permits.

Reflections on the SPU's Direction with the Consent Decree Analysis

- Near the end of the meeting, the Expert Panel was asked to reflect on the direction SPU was headed with its proposed analysis to meet the consent decree requirements. Reflections included:
  - Derek Booth said he thought the Integrated Plan team was well on its way towards evaluating the consent decree requirements of projects, as long as the team did not get "distracted" by less important analyses. Bob Pitt added that "distracted" was not the right word.
  - Bob Pitt noted the Panel had talked about providing additional detail and descriptions to explain various analyses. He would like the team to evaluate utility, not simply tradeoffs, in the exposure assessment. He also suggested considering non-linear results, and looking at contaminants individually rather than lumping them together.
  - Jean Zodrow commented that the EIVs needed more refinement, but that overall, it seemed as though the team was on a path to make the distinction that some projects are significantly better. She added that she was still struggling with having conversations in the abstract, and needed to see what the numbers do.
  - Bob Gearheart said he felt very comfortable with the direction of the team, even without having all the information. He noted that the meeting's conversation shifted from tactics to strategy. He believes MODA is useful for helping to evaluate non-technical considerations.
  - Kyle Dreyfuss-Wells noted that she felt the team was on the right track. She expressed concern, however, about the team overcomplicating the analysis ("building a complex house around a simple solution"), especially considering that this could set a national precedent.

Wrap Up and Next Steps

- Next steps identified at the meeting included:
  - There will be an **Expert Panel conference call** in August to follow up on this meeting's discussions related to the exposure assessment and the methodology to meet the consent decree requirements for the Integrated Plan.
  - The **final Expert Panel meeting** will be on **Monday, September 16, 2013,** in Seattle. There will also be a reception around this meeting to acknowledge the Panel's work.
    - This meeting will focus mostly on reviewing how SPU will show how proposed stormwater projects are significantly better than potentially deferred CSO projects, but may include some discussion of MODA.

Participants and Observers

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Derek Booth	Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
Jean Zodrow	Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO
SPU and Consultant Participants at the Table	
Kevin Buckley	Integrated Plan Project Manager, SPU
Andrew Lee	Combined Sewer Overflow Program Manager, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic
Audience Members	
Shanti Colwell	SPU
Rex Davis	SPU
Jonathan Frodge	SPU
Ed Mirabella	SPU
Pete Rude	SPU
Beth Schmoyer	SPU
Emiko Takahashi	SPU
Ingrid Wertz	SPU
Justin Twenter	Brown and Caldwell
Dan Pitzler	CH2M HILL
Rob Annear	Geosyntec Consultants
Eric Strecker	Geosyntec Consultants
Gretchen Bruce	Intertox
Rick Pleus	Intertox
Jennifer Tice	Ross Strategic
Mark Henley	Washington State Department of Ecology

Seattle Public Utilities Integrated Plan Expert Panel
Meeting #4 (Webinar), August 28, 2013
Call Summary

Participants

The fourth meeting of Seattle Public Utilities (SPU) Integrated Plan Expert Panel, a web-enabled call on August 28, 2013, was attended by four Expert Panel members, SPU managers and staff, consultants, and observers. A full list of attendees is at the end of the summary.

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
Jean Zodrow	Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO
SPU and Consultant Participants at the Table	
Kevin Buckley	Integrated Plan Project Manager, SPU
Andrew Lee	Combined Sewer Overflow Program Manager, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic

Meeting Objectives

The objectives for the Expert Panel meeting included:

- Present and obtain Expert Panel feedback on the results of pollutant load analysis for the proposed stormwater projects and combined sewer overflow (CSO) projects to be deferred in the Integrated Plan, including a comparison of loads for selected representative constituents of concern (RCOCs).
- Review the exposure assessment approach as modified since the June Expert Panel meeting, present results of the exposure assessment algorithms as applied to selected projects and RCOCs, and obtain Expert Panel feedback on the approach and the application of the methodology.
- Review upcoming meeting plans and identify next steps.

A summary of the meeting discussions, organized by the agenda topic, is below.

Summary

Discussion of Stormwater and CSO Project Load Analysis

Justin Twenter of Brown and Caldwell reviewed updates to the methodology for estimating loads for CSO projects, and then Rob Annear of Geosyntec reviewed updates to the methodology for estimating loads for stormwater projects and presented results from the preliminary pollutant load analysis for selected RCOCs for both CSO and stormwater projects. Their presentations included:

- The CSO characterization approach, based largely on simulated CSO flow from calibrated models and estimated RCOC concentrations from SPU and King County sampling results
- Estimates of the capture efficiency and volume reduction of the stormwater best management practices (BMPs) being considered for the Integrated Plan
- Methodology for evaluating water quality inputs for structural BMPs
- Updated methodology for evaluating water quality impacts of street sweeping
- Draft results for proposed stormwater projects and CSO projects being considered for deferrals for the following parameters:
  - Volume of water treated or reduced
  - Total suspended solids
  - Fecal coliform bacteria
  - Dissolved copper loads
  - Polychlorinated biphenyl (PCB) loads
  - Ammonia nitrogen loads

Expert Panel Comments and Responses

Comments on the Methodology:

- In response to a question, Eric Strecker of Geosyntec clarified that capture efficiency for stormwater projects referred to the percent treated (managing via infiltration or BMP) rather than the percent of flow held back.
- In response to a question about whether the Monte Carlo analysis was based on extreme values or event by event, Rob Annear noted that the Monte Carlo analysis uses randomly generated values from within the confidence intervals to derive the 50 percent range for the results.

Comments on the Draft Results:

- Bob Pitt and Bob Gearheart commented on the presentation of CSO project and stormwater project results in the same graphs, and that it was difficult to identify the reductions for the CSO projects since they were so small compared to the stormwater projects. Bob Pitt suggested that a log scale could show help to show the comparative results more clearly. Bob Gearheart suggested that results for CSO and stormwater projects could be displayed on different graphs.
- Kyle Dreyfuss-Wells noted that the difference in volume reductions is what is driving the difference in pollutant load reductions between CSO and stormwater projects. She said that needs to be clearly articulated. For example, Rob Annear of Geosyntec had noted that fecal coliform concentrations are higher with CSOs, but the load reductions are higher with the proposed stormwater projects rather than the CSO projects proposed for deferral since the volume being reduced is so much greater.

- In response to a question, SPU clarified that it does not need to show a positive benefit for the proposed stormwater projects compared to the CSO projects proposed for deferral on every one of the water quality pollutants for the stormwater projects to still have a significant overall water quality benefit.

Discussion of Exposure Assessment Analysis

- Rick Pleus of Intertox gave a presentation on the exposure assessment methodology and initial results from the exposure assessment analysis; his presentation covered the following topics:
  - Objectives of the exposure assessment for the Integrated Plan
  - Exposure index value (EIV) formula and calculations for human and ecological receptor factors
  - Results of EIV calculations, both summary results for the stormwater and CSO projects being considered and detailed calculations for two projects
  - The findings that the human EIVs are dominated by PCBs and fecal coliform, and that ecological EIVs are dominated by oil and grease, phosphorus and zinc (at freshwater stormwater locations), and nitrogen ammonia (at freshwater CSO locations)

Expert Panel Comments and Responses

- Several Panel members, including Jean Zodrow and Kyle Dreyfuss-Wells, commented on the "Initial Results" table in the presentation on slide 40 that displayed summary results for fifteen stormwater and CSO projects being considered for the Integrated Plan, noting in particular that the columns showing the "relative change in load" was not intuitive, especially since many of the projects with high load reductions had no change in volume.
  - Gretchen Bruce of Intertox explained that the relative change in load could be due to changes in volume, concentration, or both, and that the EIVs (in the final columns in the table) incorporate receptor factors, which are compound specific.
  - The Integrated Plan team agreed to examine ways to present the data in a more clear, and concise manner.
  - Kyle Dreyfuss-Wells added that it would be helpful to think about ways to graphically represent the exposure assessment results so that people could intuitively understand whether something was "good" or "bad" (for example, "percent reduction" makes sense).
- Jean Zodrow suggested that it would be helpful to see how the projects are broken out by RCOC. It could give a clearer picture of how the contaminants affect the EIVs, especially for ecological receptors. In particular, it could be helpful to differentiating those that have acute effects, such as fecal coliform, and those that have chronic effects.
- Bob Gearheart noted that although there are a number of factors that are subjective and/or judgment-based in the methodology, SPU and the Integrated Plan team will need to explain and market the methodology to others. Given that, it will be important to represent the methodology more clearly and to provide reference material to help establish credibility. Jean Zodrow added that the methodology was still somewhat a black box, and that it would be helpful to see actual data for where the values came from, as well as the supplementary information such as assumptions and rationales for decisions.

- Gretchen Bruce said that the team used EPA criteria for the analysis, and derived assumptions based on established references.
- Rick Pleus added that the team will be providing full data sets to SPU for documentation with the Integrated Plan with the goal of being transparent.
- Bill Ross of Ross Strategic and Rick Pleus of Intertox said that the team would work to provide more documentation for the Panel of the steps of the exposure assessment analysis and additional data to track how the calculations are made.

- Some panel members commented that the bar charts in the exposure assessment slides were hard to read. For example, on slide 43 it was not clear what the different grays were in the chart, and panel members did not know that the pollutants were displayed in the bars in the same order as in the key on the charts until it was mentioned on the call.
- Bob Gearheart said he was surprised by the high oil and grease values. Gretchen Bruce responded that the team was using State of Washington values for oil and grease, but would be looking further into what was driving the results.

Wrap Up and Next Steps

- Kevin Buckley of SPU said that the next steps for the SPU and Integrated Plan team will be to examine whether the proposed stormwater projects provide significant water quality benefits relative to the CSO projects proposed for deferral, based on load reductions and exposures, and then look at other "soft" criteria through the multi-objective decision analysis (MODA) process in selecting projects for the Integrated Plan.
- Bob Gearheart said he would be interested in working with the other Expert Panel members to prepare a letter or small report that would summarize the goal of the Expert Panel process, the methods used by the Integrated Plan team, how the Panel felt about the methods, and any recommendations for SPU. It would be an opportunity to summarize the Panel's work that could be advanced with the process.
  - The Panel members present at the meeting—Bob Pitt, Kyle Dreyfuss-Wells, and Jean Zodrow—indicated support for the idea.
  - Bob Gearheart said he would develop an outline for the letter.
- The final Expert Panel meeting will be on **Monday, September 16, 2013,** in Seattle. There will also be a reception after this meeting to acknowledge the Panel's work.
  - This meeting will include updates on the exposure assessment and load results, a discussion of SPU's approach for evaluating how proposed stormwater projects are significantly better than CSO projects proposed for deferral in terms of the consent decree criteria, and final reflections and recommendations from the Expert Panel.

Participants and Observers

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
Jean Zodrow	Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO
SPU and Consultant Participants at the Table	
Kevin Buckley	Integrated Plan Project Manager, SPU
Andrew Lee	Combined Sewer Overflow Program Manager, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic
Audience Members	
Timothy Croll	SPU
Rex Davis	SPU
Jonathan Frodge	SPU
Beth Schmoyer	SPU
Tracy Tackett	SPU
Emiko Takahashi	SPU
Justin Twenter	Brown and Caldwell
Rob Annear	Geosyntec Consultants
Aaron Poresky	Geosyntec Consultants
Eric Strecker	Geosyntec Consultants
Gretchen Bruce	Intertox
Rick Pleus	Intertox
Jennifer Tice	Ross Strategic
Dino Marshalonis	U.S. Environmental Protection Agency
Alison Evans	Washington State Department of Ecology
Rachel McCrea	Washington State Department of Ecology

Seattle Public Utilities Integrated Plan Expert Panel
Meeting #5, September 16, 2013
Meeting Summary

Participants

The fifth meeting of Seattle Public Utilities (SPU) Integrated Plan Expert Panel was attended by the five Expert Panel members, SPU managers and staff, consultants, and observers. The audience consisted largely of SPU staff and technical consultants. A full list of attendees is at the end of the summary.

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Derek Booth	Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
Jean Zodrow	Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO
SPU and Consultant Participants at the Table	
Nancy Ahern	Deputy Director, Utility Systems Management, SPU
Kevin Buckley	Integrated Plan Project Manager, SPU
Andrew Lee	Combined Sewer Overflow Program Manager, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic

Meeting Objectives

The objectives for the Expert Panel meeting included:

- Review the consent decree requirements for the Integrated Plan and Seattle Public Utilities' approach to development of an Integrated Plan.
- Present results of the exposure assessment algorithms as applied to selected projects and selected representative constituents of concern (RCOCs), and obtain Expert Panel feedback on the approach and the application of the methodology.
- Present and obtain Expert Panel feedback on the pollutant load analysis for the proposed stormwater projects and potential combined sewer overflow (CSO) projects to be deferred in the Integrated Plan, including a comparison of loads for selected RCOCs.
- Discuss the team's approach to demonstration of "Significant Benefit" and hear Expert Panel members' overall reflections and recommendations on the Integrated Plan process.

A summary of the meeting discussions, organized by agenda topic, is below. Reflections from the Expert Panel and others on the Expert Panel process are included near the end of the summary.

Review of Consent Decree Requirements and Approach for Integrated Plan

- To begin the meeting, Kevin Buckley of SPU reviewed the requirements for the Integrated Plan in the City's consent decree, which was lodged on July 3, 2013. The Integrated Plan provides an opportunity for SPU to "propose water quality improvement project(s) that will result in significant benefits to water quality beyond those that would be achieved by implementing the approved CSO control measures only." The consent decree requirements include:
  - Pollutant load reduction analysis for conventional water quality parameters for each proposed project
  - Projected pollutant reductions to water bodies with impairments (impairments have focused on pathogens, metals, dissolved oxygen, and nitrogen ammonia)
  - Projected pollutant reductions, including toxic organic compounds, to water bodies with specialized circumstances such as beach closure advisories, protected spawning grounds, and contaminated sediment cleanup sites
  - Projected reductions in pollutant exposure for humans, ecological receptors, and/or threatened or endangered species
  - Cost-benefit analysis of projects
- In addition to the consent decree requirements, SPU is using multi-objective decision analysis (MODA) to add to the significant benefit evaluation and help select projects that meet "triple bottom line" criteria.
- SPU has also selected low frequency, low volume CSO projects to analyze for potential deferral.

There were no comments or questions during this session.

Discussion of Exposure Assessment Analysis

- Rick Pleus and Gretchen Bruce of Intertox gave a presentation that walked through the details of the exposure assessment methodology and presented initial results of the analysis for human and ecological receptors. Their presentation covered the following topics:
  - The team is now calculating three separate exposure index value (EIV) metrics:
    - Human: toxics (using chronic toxicity criteria)
    - Human: fecal coliform (using acute toxicity criteria)
    - Ecological: toxics and nutrients (using chronic criteria)
  - Steps involved in the EIV calculation, which is based on concentration, water quality criteria, change in load, and the receptor factor (a measure of exposure potential)
  - Steps needed to calculate human and ecological receptor factors
  - An example of exposure assessment calculations for the South Park Water Quality Facility
  - Draft results of human and ecological EIVs for toxics and fecal coliform for all potential stormwater projects and CSO projects under consideration for the Integrated Plan
- Intertox's presentation included the formulas for the exposure assessment, sources and assumptions for the analysis, and draft summary results for the three types of EIVs.

- In response to questions, Rick Pleus and Gretchen Bruce provided the following clarifications:
  - The water quality criteria provide a way of evaluating relative hazards of different pollutants, through the calculation of pre-project concentration divided by the water quality criteria. Their approach is not a formal risk assessment, but a relative analysis of exposure across common assumptions and data sets for the stormwater and CSO projects.
  - The water quality criteria used in the analysis are either federal government or state government criteria. If there are multiple criteria available (e.g., cancerous or noncancerous reference doses), the team used the criteria with the most conservative outcome.
  - The ingestion values for exposure are based on EPA guidelines, local studies, and at times professional judgment. The team focused on data that were the closest available to the outfall. For example, if data were obtained from a local risk assessment that reported that fish consumption rates were higher (or lower) than in the EPA assumptions, the team used the local values.
  - The human receptor factor calculations are based on an average "adult" and "child."
  - In answer to a question from Bob Gearheart about whether the exposure assessment considers race, Gretchen Bruce of Intertox said that the team used mean values in its analysis, but drew from local exposure assessments that considered the local population, which would include a diverse racial population.
  - In answer to a question from Jean Zodrow about whether the human receptor factor was based on an annual average, Gretchen Bruce responded that the team calculated EIVs separately for the "high" release (cool) and "low" release (warm) seasons, in order to account for differences in exposure potential during those seasons, and then calculated an annual average EIV by weighting the average for the number of months in each season. The final EIV results for the CSO and stormwater projects are based on annual conditions.

Expert Panel Comments and Responses

- Derek Booth commented that if the water quality criteria are based on certain thresholds, there may be a more significant effect on exposure or a "step function" that occurs around that threshold as compared to the effect of similar magnitude changes in concentration that are not near the criteria level. He noted that the EIV calculations do not differentiate between changes that occur near the criteria and those that occur at other concentration levels.
  - Gretchen Bruce of Intertox responded that the concentrations are end-of-pipe concentrations, not real exposure values (no one is really exposed to this concentration of RCOCs), and that the team is using the criteria to evaluate relative exposures.
- Jean Zodrow observed that the hardness of the water could change the pre-project concentration values. She suggested looking at the average hardness and seeing how that affects the ratio of pre-project concentration to water quality criteria. Rick Pleus of Intertox said the team could do that.
- Several Expert Panel members, including Kyle Dreyfuss-Wells, Derek Booth, and Bob Pitt, commented on the fact that the denominator in the EIV equation depended on values for all projects, not just the project being analyzed. Panel members noted that SPU should consider whether to change the denominator if it changes the set of projects that it actually puts forward in the Integrated Plan.

- Derek Booth said that an alternative would be to look at pre-project and post-project loads. Mike Milne of Brown and Caldwell said that the SPU team initially saw weird results, such as large projects not looking as good as expected, when the team did not consider changes in load relative to the reductions for all projects.
- Dividing by the same value for all projects provides a way to show relative values, which Bob Pitt indicated was a good approach. Derek Booth added that although the approach may make sense, it may not be intuitive.
- Panel members raised the issue of whether SPU would be updating the value for the change in load for all projects after SPU selected its projects for the Integrated Plan, or whether the denominator would be based on the original 14 projects that were considered. Gretchen Bruce of Intertox commented that since all of the values are divided by the same total load estimate, the EIV estimates would change in a proportional manner and this update would have no effect on the final results.

- Bob Pitt said that the distance of the receptor from the outfall does not have a linear effect on exposures, although that is how the receptor values are calculated. There will be a big impact of pollutant loads on receptors that are located really close to the outfalls, but differences in distance to the receptor will not matter as much for locations that are farther away. He suggested that SPU consider using a Gaussian distribution.
  - Eric Strecker of Geosyntec noted that sediment contamination studies show a non-linear distribution of contaminants.
  - The SPU Integrated Plan team will consider other ways of evaluating the distance component of the receptor factor equation whether these alternative approaches and how much impact they will have on the resulting EIV.
- Several Expert Panel members commented on how the EIV calculations depicted uncertainty, and that in several cases the information was presented as being more precise than it actually was, based on the significant figures in the analysis.
  - For example, Kyle Dreyfuss-Wells noted that the South Park project example had 0.3 hours per month of wading, but that number actually reflects survey results extrapolated to the water body being examined.
  - Eric Strecker of Geosyntec said that the team could pay more attention to the significant figures in the results.
  - Bob Pitt said that the most important thing would be to truncate the final result based on the significant figures.
  - A few panel members commented that it was surprising that one project accounted for 22 percent of the total reduction in zinc across all the projects, and they suggested that SPU double-check the numbers. Beth Schmoyer of SPU noted that this was a large project in an industrial basin, but said the team would take another look at the results.
- Bob Gearheart commented that the receptor factors for humans should indicate the number of people that the estimates apply to, not just the time for potential exposure over a given period. Gretchen Bruce of Intertox responded that this is incorporated implicitly into the overall “likelihood of exposure” estimate.

- Derek Booth asked the team how much variability there was in the data for the relative change in load for the RCOCs, as that part of the EIV calculation relates to project effectiveness and will be a large driver in the end results. He also noted that the column that has the most variability in the equation will drive the results.
    - Rick Pleus agreed, and noted that the choice of RCOCs also drives the outcome. Derek Booth and Jean Zodrow commented that there was a history of why SPU selected the RCOCs, and that this was based in part upon data availability.
- Bob Pitt said he found it difficult to evaluate the differences between projects when the results were not normalized by volumes (the differences could be due to the size of the project and/or the effectiveness of the treatment controls).
    - He noted that for the table that showed projects with the volumes on slide 50 of the presentation, the projects seemed to generally be ranked according to the volume reduction.
    - One exception to the trend that the better ranked projects reduced the most volume were the Longfellow Creek projects, which may imply that SPU should evaluate whether more can be done to address the water quality problems in that area.
- Derek Booth asked why the figure 91 percent volume reduction was so common across the stormwater projects.
    - The SPU team responded that 91 percent is an estimate of the flow reduction from bioretention projects; it is not location specific. Members of the team added that this estimate would likely be revised to 80 percent.
- Expert Panel members also provided several comments on how the information was presented, as follows.
    - Kyle Dreyfuss-Wells said that it would be important to document the additional clarifications and explanatory statements provided during the meeting as part of the Integrated Plan.
    - Bob Pitt noted that the slides would be clearer if they used consistent units across slides for concentrations (micrograms/liter or milligrams/liter).
    - Derek Booth and Bob Pitt commented on how the team described the duration of exposure, and noted that since hours per day is what is in the calculation, the team could describe exposures as a range of least to most likely, without converting them to a 1-to-5 scale. Gretchen Bruce of Intertox agreed.
    - Bob Pitt suggested that the arrows on slide 43 indicating the amount of time for different activities (e.g., 0.3 hours/month of wading) could be represented as bars to show the ranges instead of precise point values. It was also noted that February was omitted from this slide in the seasons (it should be February-September, not March-September).
- Kyle Dreyfuss-Wells observed that the EIV calculations are very complex, with a lot of assumptions, and they can raise a number of questions. It is important to be comfortable about the analysis, but also, when communicating the results of the analysis, it is important for there to be a clear message. The data should “pop.” If the results are confusing or unclear, there is a risk that the Integrated Plan could be poorly understood when the actual results are quite clear. The “sale” of the Integrated Plan and the analysis behind it needs to be considered. She suggested a FAQ document could be helpful.
    - Bob Pitt added that it is important to have defensible analysis (for example, looking at distance to receptors as a non-linear function).

- Jean Zodrow noted that people will have preconceived notions, such as copper is bad for salmon in the Northwest, so it will be important to frame the results in terms of people's reference point to get the message across. Transparency is important, so communicating what the exposure assessment analysis provides will be important.
- Bob Gearheart suggested doing a sensitivity analysis to see what changes the results and what does not.

Observer Comments and Responses

- Rob Grandinetti of the U.S. Environmental Protection Agency (EPA) asked why SPU selected the specific RCOCs it did, such as copper and zinc.
  - Kevin Buckley of SPU said that SPU chose to use copper and zinc as RCOCs for the consent decree requirement to evaluate reductions in metals. Copper is a concern for species, and Eric Strecker added that it has been cited by NOAA Fisheries in biological opinions. Zinc has been present in industrial discharges in the city.
  - SPU's process and rationale for selecting RCOCs for the pollutants identified in the consent decree was more fully described in the background materials and presentations provided to the Expert Panel in April and June.
- Rachel McCrea of the Washington Department of Ecology asked how the Integrated Plan team derived the 3 hours per month estimate for fishing for the example exposure assessment calculations for the South Park project in the Duwamish River basin.
  - Gretchen Bruce said the estimate was based on a King County survey and was not specific to the Duwamish River.
  - Rachel McCrea said that there is specific information about the Duwamish River and immigrant use of it, but she is reserving judgment and not disputing the numbers.
- Rob Grandinetti of the U.S. EPA said that he was not clear how the EIV calculations allow for comparison across pollutants.
  - Andrew Lee of SPU and Rick Pleus of Intertox responded that the water quality criteria allow for the comparison of the relative hazard from different pollutants. Andrew Lee of SPU added that PCBs will make up a larger proportion of the EIV because they have high concentrations.
- Jonathan Frodge of SPU asked the Integrated Plan team why they only considered migratory species of fish (salmon) in the exposure assessment, and not non-migratory fish such as pile perch. He said state data show non-migratory species are a bigger issue for consumption than migratory species.
  - Rick Pleus of Intertox clarified that the human EIV calculations include migratory and non-migratory fish species (an average across all fish consumed).
  - It is the ecological EIV that uses salmon species as ecological receptors. SPU focused initially on threatened and endangered species as a means of meeting the consent decree requirements, and then decided to consider other species of salmon as other ecological receptors.
- Jonathan Frodge of SPU suggested that the Integrated Plan should emphasize that its goal is to select stormwater projects that will provide significant receiving water quality improvements compared to the deferred CSO projects, rather than to fully restore the receiving bodies.

Highlights of Stormwater and CSO Project Pollutant Load Analysis

- Justin Twenter of Brown and Caldwell and Rob Annear of Geosyntec provided updates on the pollutant load reduction analysis for CSO and stormwater projects being considered for the Integrated Plan, and reviewed the draft results for several key parameters.
  - Since the August Expert Panel webinar, the SPU Integrated Plan team simulated load reductions for CSO projects in the Long Term Control Plan (LTCP) that are not being considered for deferral to provide additional context for the analysis of projects for the Integrated Plan.
  - The presentation covered draft results of the pollutant load analysis for stormwater and CSO projects being considered for the Integrated Plan (and additional LTCP projects for some pollutants), focusing on volume treated/removed, total suspended solids, fecal coliform, dissolved copper, PCBs, and ammonia-Nitrogen. Results were shown in log and non-log scales.
  - The Integrated Plan team is working on several adjustments and updates to approach to evaluating stormwater project loads, including:
    - Revisiting the land use effluent mean concentrations for a few RCOCs
    - Refining the team's understanding of data collected for fecal coliform load reduction from street sweeping projects to ensure that estimates are sufficiently conservative regarding removal efficiency
    - Refining the approach for representing the performance of bioretention facilities

Expert Panel Comments and Responses

- Derek Booth commented on the fact that the street sweeping projects showed very high load reductions for many RCOCs, yet there were no error bars shown for those results, whereas other projects showed error bars indicating the uncertainty range.
  - Rob Annear of Geosyntec said that the load reduction estimates for street sweeping projects would be broken down by season (like other projects) and the team would be adding error bars.
  - He added that the street sweeping results are preliminary and most likely will come down. As noted above, the team is reevaluating the fecal coliform data collected for street sweeping projects, in particular, to make sure that load reduction estimates are sufficiently conservative.
  - Bob Pitt added that he would like to see the load reduction results for street sweeping projects, along with the supporting documentation, because the numbers were so high.
- Derek Booth also suggested that since there was not much variation in the results by season, perhaps SPU does not need to show both.
  - Rob Annear of Geosyntec said that the team did not know that there would not be significant seasonal variation until the data analysis was completed.
- Bob Gearheart asked whether there were any "pre-conditions" for projects, in particular whether street sweeping would eliminate load reduction benefits from other projects.
  - A member of the Integrated Plan team said that there would be some overlap across projects, but not much.
- Kyle Dreyfuss-Wells asked how the team was considering other flows that enter the system, such as sanitary sewer overflows and infiltration and inflow (I&I) from leaky pipes and other sources.
  - Rob Annear said that the team is using data collected by SPU that would reflect any I&I that occurred. There is some uncertainty in that SPU does not have groundwater sampling data.

- The Integrated Plan team asked for the Expert Panel's perspectives on different approaches for estimating pollutant load reductions from natural drainage systems, based on assumptions about whether water leaving biofiltration facilities enters the receiving waters, goes into an underdrain, or is "treated" as it goes through the ground (100 percent removal of pollutants). Tracy Tackett of SPU indicated that SPU plans to use a conservative estimate that half the biofiltration projects will have underdrains and half will discharge to the receiving waters. For the half with underdrains, data from past studies will be used to estimate the pollutant removal. For the half without underdrains, the assumption will be that there is 100 percent pollutant removal for the volume treated (80 percent).
    - Bob Gearheart indicated that it made sense to consider groundwater quality in considering the effects of projects on the receiving waters.
    - Bob Pitt said that the filters provide good removal, and that if underdrains are not included, the remaining water could go to the groundwater. The main problem with flows getting to the receiving waters after being filtered is when the underdrain is daylighted. This is primarily an issue for organic toxics, not metals. He added that local experience with biofiltration is critical.
    - Bob Pitt said that he thought SPU's proposed assumptions for where flows from biofiltration projects would end up seemed reasonable (literature values for removal efficiency of projects discharging to underdrains / 100 percent pollutant removal for projects discharging to groundwater).
    - In response to a question, SPU confirmed that it would also be changing the amount of volume treated by biofiltration projects from 91 to 80 percent, as mentioned earlier.

Observer Comments and Responses

- Mark Henley of the Washington Department of Ecology commented that his understanding was that the load reduction values were based on actual data for CSO projects, but based on published values for the stormwater projects.
    - Rob Annear of Geosyntec and Kevin Buckley of SPU responded that the stormwater project values are based on data collected locally, although the data are not specific to the project sites. The CSO project load reduction values are also modeled.
        - The Integrated Plan team examined the land uses relevant to the stormwater project sites, the range of pollutant loads coming from those land uses, and the estimated project performance based on the effectiveness of similar stormwater best management practices.
        - The load estimates from land use are based on the City's NPDES stormwater characterization data, which was collected for three sites. The team then compared those data to data from sites in Tacoma, Washington, and Western Oregon, as well as national data, using box plots and showing 95 percent confidence intervals.
    - Eric Strecker of Geosyntec added that for many projects there is less concentration data available for CSO projects than for stormwater projects.
- Rob Grandinetti of EPA asked how the street sweeping projects being considered for the Integrated Plan differ from what SPU is required to do under its MS4 municipal stormwater requirements.
    - Kevin Buckley of SPU responded that street sweeping is not required by the MS4 permit but that SPU is doing some street sweeping (every other week in certain areas of the city) as part of the structural controls in its stormwater management plan. The street sweeping projects and other

stormwater projects being considered for the Integrated Plan are in addition to the stormwater pollution controls in the City's MS4 permit.
    - Rachel McCrea, the City's MS4 permit manager at Ecology, confirmed that street sweeping is not a requirement in the MS4 permit.
    - SPU is considering two street sweeping projects for the Integrated Plan: Phase 1, which will expand the miles of sweeping; and Phase 2, which will extend sweeping into residential areas.
    - Rob Grandinetti also asked whether the street sweeping data were monitoring and/or modeling results. Kevin Buckley of SPU said that street sweeping performance data are collected monthly as a composite sample, and then examined for the wet and dry seasons.
- Mark Henley of Ecology said he was surprised that the LTCP CSO projects (for some of the larger CSOs in SPU's system, CSOs #147 and #152) included in the comparison with potential Integrated Plan projects did not show much difference in load reductions from the stormwater projects. He said he would expect that the results for fecal coliform reductions for those CSO projects should be even higher than shown since they are addressing large volume CSOs.
    - Eric Strecker said that the stormwater projects discharge more often than the CSO projects, and that CSOs are composed largely of stormwater, so those factors minimize the differences.
    - Andrew Lee of SPU commented that since the load reductions of CSO projects 147 and 152 are comparable to the proposed stormwater, SPU is not proposing to defer those CSO projects. In addition, those CSO projects would show a better "bang for the buck" with respect to fecal coliform load reductions.
    - Eric Strecker of Geosyntec said that the team could add a description to help explain the results.

Discussion of Approach to Demonstration of Significant Benefit

- Kevin Buckley of SPU and Mike Milne of Brown and Caldwell gave a brief presentation on how SPU is thinking about approaching the demonstration of significantly greater water quality benefits from the stormwater projects proposed in the Integrated Plan to those CSO projects proposed for deferral. Their presentation covered the following:
    - SPU will evaluate "packages" of stormwater and CSO projects according to the consent decree criteria, including:
        - Pollutant loads
        - Exposure
        - Water body characteristics (considering impaired water body status, frequency of overflows, volume treated, etc.)
    - As part of its analysis, SPU is considering how the pollutant load reductions for individual stormwater projects compare to the load reduction benefits of all the CSO projects SPU is considering for deferral.
    - To help show significant benefits, SPU is planning to present a bar graph of the total load reductions of all stormwater projects proposed in the Integrated Plan compared to the benefits from all CSO projects to be deferred. (The graphs in the presentation depicted results for all 14 stormwater projects under consideration, but similar graphs would be produced after SPU selects a subset of stormwater projects for the Integrated Plan. The bar graph results were shown with and without the street sweeping results, since those numbers were in flux.)

- In addition, SPU will examine the EIVs for stormwater projects as compared to the CSO projects; however, unlike the graphs for the pollutant loads, the EIV graphs uses the "most beneficial" CSO project as the baseline for comparison rather than using a baseline derived from summing the EIVs for all CSO projects being considered for deferral.
- Overall, most individual candidate stormwater projects show significant benefits above all potentially deferred CSO projects, according to loads, EIVs, and frequency. Multiple combinations of stormwater projects would provide even more significant benefits as compared to all the potentially deferred CSO projects.
- SPU will consider cost-effectiveness and other objectives (e.g., through the MODA process) to choose the final set of stormwater projects that will have load reductions and EIVs that far exceed the deferred CSO projects.

Expert Panel Comments and Responses

- Kyle Dreyfuss-Wells commented on the differential benefit shown between stormwater and CSO projects in the graphs. She asked whether any project that fell below the dotted black line representing the loads for all CSO projects (or the best CSO project, for EIVs) would be excluded from the Integrated Plan.
  - Mike Milne of Brown and Caldwell indicated that SPU would be choosing packages of projects that significantly exceed the load or exposure reduction benefit from the CSO projects, rather than excluding individual projects solely based on that comparison.
- Derek Booth indicated that there will be a lot of scrutiny on the results, and people could question them because they are so much in favor of stormwater projects—questioning why the projects had not already been done or questioning the validity of the results.
  - Mike Milne of Brown and Caldwell responded that SPU has a lot of "low-hanging fruit" with stormwater projects, while the City has already done most of the work to control CSOs; current CSO volumes are a fraction of what they were 20-30 years ago. The candidate CSO projects for potential deferral would address relatively small CSOs that are nearly under control. SPU has deliberately "stacked the deck" by identifying candidate stormwater projects that are expected to provide substantial water quality benefits compared to the small CSO projects that are candidate for deferral. That is one benefit of being able to do an Integrated Plan.
  - Nancy Ahern of SPU commented that regulatory drivers for CSO and stormwater control differ, and that one of the benefits of the Integrated Plan is that it lets the City prioritize implementation of stormwater projects that will have significant water quality benefits in the near term.
  - Derek Booth noted that comparing the stormwater projects to all the CSO projects is potentially doing the City a disservice in that the stormwater projects that do not show as good of benefits still outperform most of the CSO projects to be deferred. He thought it would be better to show why those stormwater projects were selected.
  - He also suggested that more precise project names, such as the amount of linear feet of natural drainage systems (NDS or green infrastructure), could be helpful rather than using general labels such as "NDS partnering." Bob Pitt added that many of the projects could probably be scaled.

- Bob Gearheart recommended that SPU consider the cost per pound of pollutant removal in comparing projects.
  - Kevin Buckley said that the combined costs for the deferred CSO projects is around $50-75 million, while the potential stormwater projects from which the City will choose is $150 million, so SPU will not propose all of them.
  - Kyle Dreyfuss-Wells said that it is not a fair comparison if SPU is comparing $150 million in stormwater projects to $75 million in CSO projects. The focus of the significant benefit analysis for the consent decree is on load reductions and other aspects of water quality. She added that it is important to note that the significant benefit analysis does not look at other co-benefits of stormwater projects for the community.

Observer Comments and Responses

- Mark Henley of Ecology noted that SPU intentionally chose CSO projects to defer that were low volume, and close to being controlled. Due to this, he is concerned about the potential for this plan to be taken out of context and used to undermine CSO control nationally.
  - Andrew Lee of SPU said that SPU would tell the story of how it selected CSOs that were nearly under control (had overflow frequencies close to the state standard of one event per outfall per year), and note that Seattle is different from other locations in that it manages smaller basins and has controlled most of the historical CSO volume already (e.g., reducing volumes from 20 billion million gallons initially to 200 million gallons now annually).
  - Kyle Dreyfuss-Wells agreed with that point, noting that Cleveland would never consider not addressing CSOs in its community that occur 40 to 80 times per year.
  - Rob Grandinetti added that there are significant flow disparities among cities; if five percent of New York City's discharges were controlled by green infrastructure, then that could represent more than the total volume in Seattle's municipal system.
  - One panel member suggested that an alternate graph could be to show the load reductions / volume treated for all CSO projects being deferred as well as for all the CSO projects in the LTCP.
- Rob Grandinetti of EPA asked how the SPU team derived the estimate of 150 stormwater discharges per year.
  - Kevin Buckley of SPU responded that 150 discharges per year was an educated guess, but that a better estimate would be calculated.
  - Beth Schmoyer of SPU suggested that the team could evaluate rain gage data to produce a better estimate.

Next Steps for the Integrated Plan Team and Summary Observations

- Kevin Buckley of SPU reviewed the next steps in SPU's overall process for the Integrated Plan, which include:
  - Reviewing/refining aspects of the Integrated Plan methodology and data as they pertain to street sweeping and natural drainage systems
  - Finalizing the pollutant load reduction estimates and the exposure assessment
  - Completing the significant benefit evaluation of potential projects for the Integrated Plan
  - Conducting a cost-benefit analysis of the potential Integrated Plan projects

- Developing packages of stormwater and CSO projects and analyzing them in the MODA process
- Submitting drafts of the Integrated Plan along with the Long Term Control Plan, Environmental Impact Statement, and a summary/overview to EPA and the Washington Department of Ecology by May 2014

- He noted that this meeting was the formal end of the Expert Panel process, but asked the Panel and observers if there were other areas where it would be useful for the Expert Panel to provide input on the methodology/approach.

Expert Panel Comments and Responses

- Bob Gearheart said he would like the Expert Panel to draft a letter to SPU with observations and recommendations from the Panel. He has worked with Jennifer Tice of Ross Strategic to prepare a draft outline of the letter, which was shared with the Expert Panel at the meeting.
- The group discussed the desired audience for the letter. Derek Booth suggested that it should be focused on SPU, but will be read by SPU management, the collective technical staff working on the Integrated Plan, the regulatory agencies, and others. Nancy Ahern of SPU added that the main audience should be SPU management, but that it will also be useful for the City Council, as it will help provide a lay perspective on the methodology.
  - Kyle Dreyfuss-Wells said that the City Council will focus on the summary and the list of panel members.
- Observations of the Expert Panel on SPU's Integrated Plan approach and ideas that the group discussed for the letter included the following:
  - Kyle Dreyfuss-Wells said that overall she feels very positive about SPU's Integrated Plan approach, but she has some concern about it being over complicated. It is important that SPU not lose the forest for the trees, since overall this is a "good news" story.
  - Jean Zodrow noted that SPU has used good science, with reasonable approaches and some innovations. The team has presented this information well. The exposure assessment was a "black box" earlier in the process, but the Expert Panel has looked at the science and finds it to be reasonable.
  - Bob Pitt said he found the Integrated Plan methodology to be an intriguing approach. There are some data gaps, and he expressed some concern that SPU had not covered how to explain remaining uncertainties that thoroughly. With large differentials in the results between stormwater and CSO projects, as long as the uncertainty bands are smaller than the overall differential, the results will hold.
  - Derek Booth echoed Bob Pitt's comments in saying that the overwhelming difference in the volumes treated between the stormwater and CSO projects forgives many of the uncertainties and questions about the data. He added that it is appropriate to do a good job on the individual elements of analysis, but that should not undermine the common-sense outcomes the project is heading towards. Overall, it should be clear that it makes sense to do the proposed stormwater projects in the Integrated Plan and defer the CSO projects.
  - Bob Gearheart observed that one of the things that he is taking away from this process is the way that the team has used site-specific information to make decisions about performance management.

- Comments that the group had about the relevance of this process to other communities included:
  - Bob Pitt noted that other communities are driven more by economics in their decision-making. They may need to show additional benefits from stormwater/green projects in order to show that they make sense from a cost-benefit standpoint.
  - Kyle Dreyfuss-Wells said that she thinks that overall the level of scrutiny on integrated planning is necessary at this point.
- Comments that the group had about the Expert Panel process included:
  - Jean Zodrow said that SPU was great at responding to comments.
  - Kyle Dreyfuss-Wells commented that she benefited from the process, and thought that utilities should share more about their efforts.
  - Bob Pitt said that the process was very condensed, but involved a good mix of participants.
  - Derek Booth observed that big and small issues raised by Expert Panel members seemed to receive equal weight/treatment. He suggested that the Expert Panel might have had an opportunity to form more refined/focused opinions and coalesce as a group if the panel members had had an opportunity to meet as a group on their own early on in the process
  - Kyle Dreyfuss-Wells added that if each panel member had been given 15 minutes to share his or her background at the first meeting/call, it might have allowed people to better tap each other's expertise.

Observer Comments and Responses

- Mark Henley of Ecology said that he would like the Expert Panel to provide more input on the street sweeping project alternatives and, in particular, on the assumptions about the effectiveness of street sweeping at reducing fecal coliform loads and how that compares to observed/sampled data.
  - SPU agreed and will be holding a call with the Expert Panel on the approach for the street sweeping alternatives in late October.
- Rob Grandinetti of EPA asked the group how the estimated pollutant load reductions would be evaluated and quantified after the projects are implemented, and whether SPU would be committing to those load reductions (e.g., 80 percent removal). Mark Henley of Ecology added that the consent decree specifies what the City must do if it does not meet its commitments.
  - Kevin Buckley of SPU said that this issue of tracking pollutant load reductions during implementation would be addressed as part of the City's post-construction compliance monitoring plan, which is a required part of the City's consent decree submittal.
  - Rob Annear noted that the estimates the team has developed have uncertainty bands associated with them, and that provides an indication about the confidence in individual results.
- Alison Evans of Ecology asked whether the Expert Panel had seen all the data they were interested in reviewing to feel comfortable with SPU's approach to the Integrated Plan. She added that Ecology would like to see a summary of the data that SPU used, the calculations performed, and the results.
  - Kevin Buckley of SPU and Rob Annear of Geosyntec said that the Integrated Plan team had presented a summary of the data used in the Integrated Plan analysis and where it came from, the methodology, the assumptions, and the results to the Expert Panel.
  - At the April Expert Panel meeting, the team presented the summary of the data sources and the assumptions.

- Bill Ross of Ross Strategic clarified that the Expert Panel had not done a quality control review on the data entry.
- Kyle Dreyfuss-Wells commented that what the Expert Panel asked for in terms of more details about the methodology and the numbers that SPU is using, particularly on the exposure assessment methodology, is what the SPU Integrated Plan team presented to the Panel at this meeting. She said that with the exception of additional information on the street sweeping project alternatives analysis, the Panel has been able to review the information it requested.
- Derek Booth noted that the Expert Panel was never asked to serve in an approval or judgment role; rather, SPU has asked the Expert Panel for opinions on topics related to its Integrated Plan methodology. SPU is not required to do anything with the Expert Panel's comments. He feels like the Panel has been of use to the utility in the Integrated Plan development process, and does not feel a need to explore into the data in more detail.
- Bob Pitt said that the April presentations did show that summary of the data and sources, and noted that for some of the results that looked "funny" (street sweeping/fecal coliform), it could be useful to look at those data further.

Wrap Up and Next Steps

- In wrapping up, Kevin Buckley of SPU said he and the Integrated Plan team have gotten the type of input they sought from an expert panel. The team meets after each Expert Panel meeting to review the suggestions and discuss how to proceed. He appreciates that he can call individual panel members to discuss specific issues. The Expert Panel reviewed more than just the methodology in the last couple of meetings, by looking at the results of the analysis of projects being considered for the Integrated Plan, but he said he was glad SPU sought the Expert Panel's input on these issues.
- Mike Milne of Brown and Caldwell added that he thought the Expert Panel's input had added a lot to the Integrated Plan. Eric Strecker of Geosyntec and Rick Pleus of Intertox said the ability to ask questions of the Expert Panel was valuable, and the panel's input was extremely helpful.
- Nancy Ahern of SPU said that the utility has gotten a huge amount out of the Expert Panel's discussions.
  - SPU continues to be very excited about opportunity to do the Integrated Plan. The Integrated Plan is groundbreaking work that will allow SPU to make the case for implementing stormwater projects in the near-term and delaying regulatorily required, low-priority CSO projects.
  - The conclusions that might be simple in Seattle's context may be harder to derive in other contexts. She said she thought the Expert Panel has done a great service for other communities working on integrated planning processes.
  - Nancy Ahern thanked the Expert Panel, the SPU and consultant team working on the Integrated Plan, and the regulators observing the process.
- Bill Ross of Ross Strategic suggested that the Expert Panel would like to be kept informed about the Integrated Plan as SPU selects projects and as regulatory agencies review the Integrated Plan.
  - Bob Gearheart agreed and said that perhaps SPU could send a newsletter to update the Panel. He would like to see how the process turns out.
  - Nancy Ahern said that SPU would keep the Expert Panel informed about the outcomes of the Integrated Plan.

- Next steps identified at the meeting included:
  - SPU plans to convene the Expert Panel for a **conference call on October 23** to discuss the methodology and data for evaluating street sweeping alternatives for the Integrated Plan.
  - Ross Strategic will work with Bob Gearheart and other Expert Panel members to draft a letter summarizing the Expert Panel's observations about SPU's approach to the Integrated Plan.

Participants and Observers

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Derek Booth	Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
Jean Zodrow	Project Toxicologist, ARCADIS U.S., Inc., Lakewood, CO
SPU and Consultant Participants at the Table	
Nancy Ahern	Deputy Director, Utility Systems Management, SPU
Kevin Buckley	Integrated Plan Project Manager, SPU
Andrew Lee	Combined Sewer Overflow Program Manager, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic
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Ed Mirabella	SPU
Charles Oppelt	SPU
Beth Schmoyer	SPU
Tracy Tackett	SPU
Ingrid Wertz	SPU
Justin Twenter	Brown and Caldwell
Kurt Playstead	CH2M HILL
Theresa Wagner	City of Seattle, Attorney's Office
Rob Annear	Geosyntec Consultants
Eric Strecker	Geosyntec Consultants
Gretchen Bruce	Intertox
Rick Pleus	Intertox
Jennifer Tice	Ross Strategic
Rob Grandinetti	U.S. Environmental Protection Agency
Alison Evans	Washington State Department of Ecology
Mark Henley	Washington State Department of Ecology
Rachel McCrea	Washington State Department of Ecology

Seattle Public Utilities Integrated Plan Expert Panel
Meeting #6 (Webinar), October 23, 2013
Call Summary

Participants

The sixth meeting of Seattle Public Utilities (SPU) Integrated Plan Expert Panel, a web-enabled call on October 23, 2013, was attended by five Expert Panel members, SPU managers and staff, consultants, and observers. A full list of attendees is at the end of the summary.

Name	Organization
Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Derek Booth	Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA
Kyle Dreyfuss-Wells	Manager of Watershed Programs, Northeast Ohio Regional Sewer District, Cleveland, OH
Bob Pitt	Cudworth Professor of Urban Water Systems, Department of Civil, Construction, and Environmental Engineering, University of Alabama, Tuscaloosa, AL
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SPU and Consultant Participants at the Table	
Kevin Buckley	Integrated Plan Project Manager, SPU
Andrew Lee	Combined Sewer Overflow Program Manager, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic

Meeting Objectives

The objectives for the Expert Panel meeting included:

- Provide an overview of SPU's street sweeping program and the potential street sweeping projects being considered as part of the Integrated Plan.
- Present and obtain Expert Panel feedback on SPU's methodology and use of data for estimating the pollutant load reductions from street sweeping projects being considered for the Integrated Plan.
- Provide an opportunity for final Expert Panel observations and recommendations on the Integrated Plan approach.

A summary of the meeting discussions, organized by the agenda topic, is below.

Summary

Introduction

At the beginning of the meeting, Kevin Buckley of SPU noted that this webinar was intended as a follow-up discussion following the September 16th Expert Panel meeting when several Expert Panel members and observers had had questions about the methodology and preliminary pollutant load reduction results for street sweeping projects.

- On October 17, two SPU staff in the street sweeping program, Louise Kulzer and Shelly Basketfield, had a conference call with Expert Panel member Bob Pitt so that they could hear his comments firsthand, as they had not attended the September 16th meeting. Notes from that call were distributed as part of the meeting materials for this webinar.
- Bob Pitt said that he had appreciated the opportunity to provide his comments to SPU.

Discussion of Methodology for Estimating Pollutant Load Reductions from Street Sweeping Projects Being Considered for the Integrated Plan

- Shelly Basketfield of SPU gave a presentation on SPU's street sweeping program, the two projects SPU is considering for the Integrated Plan, and how SPU is estimating the pollutant load reductions that could be anticipated from those projects. Her presentation covered:
  - The City's current street sweeping for water quality program and what it has achieved
  - The two projects being considered for the Integrated Plan ("phase 1" and "phase 2" street sweeping)
  - Assumptions SPU used to estimate the alternatives' water quality benefits (the assumptions related to street dirt washoff particle distribution, representative sample concentrations, representative pickup rates for Seattle, and representative pickup rates for alternatives)
  - The process to develop water quality benefit estimates based on street sweeper pickup rates and estimated washoff pollutant load and concentration reductions
- She noted that SPU had revised its methodology since the September Expert Panel meeting to produce more conservative estimates. The key changes to the methodology included using only wet season fecal coliform data (instead of wet and dry season data) and using particle washoff rates derived from a study in Bellevue, WA conducted by Bob Pitt, which reduced SPU's previous estimates of the percentage of particles picked up by the sweeper that would have been washed off.
- After Shelly Basketfield's presentation, Rob Annear of Geosyntec gave an overview of the pollutant load reduction estimates for the street sweeping projects in the context of other stormwater projects being considered for the Integrated Plan and potential CSO control projects to defer.
- Key changes the Integrated Plan team made to the results since the September meeting included:
  - Refining the effluent mean concentrations (EMCs) for different land uses
  - Narrowing the scope of the natural drainage system (NDS) partnering
  - Incorporating the assumptions discussed in September related to underdrains for NDS (50 percent of NDS will have underdrains, and for those NDS projects with underdrains, the assumption is that all pollutant removal occurs within the bioswale, so load reduction estimates are based on the estimated RCOC concentrations in the underdrains), and

- Refining the estimates of street sweeping load reductions.

- These changes reduced the load reduction estimates for stormwater projects, but in general they still remained larger than those for most CSO projects being proposed for deferral. The exception to this trend was ammonia-nitrogen (ammonia-N), for which some of the CSO projects proposed for deferral showed greater load reductions than did many of the proposed stormwater projects.
  - This is consistent with the team's previous results, which indicated that the candidate CSO projects would provide greater ammonia-N load reductions than most stormwater projects. The new assumptions for the NDS Partnering and Piper's Creek Bioretention project resulted in lower ammonia-N load reductions for those projects.
- Draft results shown in the presentation included:
  - Volume treated/removed
  - Total suspended solid loads
  - Fecal coliform loads
  - Dissolved copper loads
  - PCB loads
  - Ammonia-nitrogen loads

Slides from Shelly Basketfield and Rob Annear's presentations were distributed with the materials for the webinar and contain more information about the above topics.

Expert Panel Comments and Responses

- Bob Gearheart asked whether there would be an increase in biological oxygen demand (BOD) and chemical oxygen demand (COD) over time as the material in the pile decomposed.
  - Rob Annear of Geosyntec said that there would be some decay that occurs in the 14-day window before samples are collected from the pile.
  - Bob Pitt said that BOD is not a stable component (it varies over time and that can complicate laboratory results), and that COD is a more consistent measure, although there is a lag time for evaluating COD. Because of the lag time provided in the pile, Bob Pitt said he thought that SPU would probably be okay with its analyses for BOD/COD.
- In answer to a question from Eric Strecker of Geosyntec about using COD to predict BOD using standard stormwater ratios, Bob Pitt said the delay time for evaluating COD is several days, not a few hours. He added that that the ultimate BOD value will be closer to the COD. To fully evaluate these relationships, a BOD rate study of 10-15 lab analyses would need to be done.
  - Rob Annear said that one of the representative constituents of concern (RCOCs) is BOD, so if SPU is unable to using the ratio of COD to BOD-5, it will need to look at BOD.
  - Following the webinar, Bob Pitt forwarded a chapter of a monitoring book to the Expert Panel and the Integrated Plan team that contained more information about studies of BOD in urban runoff. Research conducted by Dr. Pitt in 1979 showed that BOD from urban runoff after a 10-20 day incubation period can be 5-10 times greater than the BOD levels after 1-5 days.
- In answer to a question from Jean Zodrow, Rob Annear clarified that for dissolved copper, it is not necessarily the case that the street sweeping projects would have "no reduction" in dissolved

copper loads, but rather that SPU does not know what the load reduction would be so the SPU team assumed zero reductions to be conservative.

- Bob Gearheart commented that some of the projects could have synergistic or cumulative effects, and it was not clear whether the results accounted for any potential double-counting.
- Near the end of the discussion, Bill Ross of Ross Strategic asked each Expert Panel member to comment on his/her overall reactions to the street sweeping methodology and the draft pollutant load reduction results. Their responses were as follows.
  - Kyle Dreyfuss-Wells and Derek Booth both said that the methodology seemed reasonable, although they noted that this was not their area of expertise.
  - Bob Pitt said that the overall methodology for evaluating street sweeping project pollutant load reductions seemed fine, and that SPU was using reasonable assumptions and correct calculations. He encouraged SPU to conduct monitoring of street sweeping and any other stormwater projects that are implemented under the Integrated Plan.
  - Derek Booth added to Bob Pitt's comments that given the cost of this effort, monitoring would be worthwhile.
  - Jean Zodrow asked about the uncertainty in the estimates for street sweeping, and whether the adjustments had generally been overestimates or underestimates.
    - Aaron Poresky of Geosyntec said the Integrated Plan team looked at the variability in the monitoring data in the bins, characterized the uncertainty in that data, and used a Monte Carlo analysis to apply that uncertainty to the ranges of load reduction estimates for street sweeping projects. He added that SPU does not yet have a clear picture about the central tendency of the results.
    - Jean Zodrow said that that approach made logical sense to her.
  - Bob Gearheart noted the uncertainty/confidence ranges will be important for street sweeping, since there are less data for that type of project. In addition, there is an opportunity to monitor, sample, and add to the stock of knowledge regarding the efficacy of street sweeping programs, which would be of great benefit for other jurisdictions contemplating street sweeping.

Observer Comments and Responses

- Mark Henley of the Washington State Department of Ecology asked whether there would be bacterial regrowth in the wet season pile, and whether this would overestimate fecal coliform bacteria removal.
  - Shelly Basketfield of SPU said that when the overall runoff concentrations and SPU's assumptions are considered, she thinks that the results will still be conservative. However, the City plans to continue to look at the fecal coliform levels and do more sampling.
  - Overall, fecal coliform concentrations are low because SPU is only using wet season data.
- Mark Henley of Ecology asked how the volume treated was calculated for street sweeping projects, since the sweepers are not running all of the time it is raining.
  - The SPU team replied that it calculated the amount of land associated with the area being swept (streets and connected sidewalks) to estimate annual runoff volume of streets being swept.
- Mark Henley of Ecology said that the consent decree requires post-construction monitoring for options in the Integrated Plan, so he encouraged SPU not to overestimate load reductions since he

said they would need to be verified, and if load reductions were not as estimated, SPU may be required to construct additional stormwater projects to make up the difference.

Wrap Up and Next Steps

- Bob Gearheart said that the Expert Panel had worked with the support of Jennifer Tice of Ross Strategic to develop a letter summarizing the Expert Panel's observations and recommendations for SPU related to the Integrated Plan. He said that the Expert Panel would add anything relevant related to this call, and that they expected to finish the letter in a couple of weeks.
- Kevin Buckley of SPU thanked the Expert Panel for their participation in the process and their input on the Integrated Plan methodology. He said that although this was the final meeting of the Expert Panel, SPU plans to keep the Expert Panel informed about developments with the Integrated Plan.

Participants and Observers

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Expert Panel Members	
Bob Gearheart, Chair	Professor Emeritus, Humboldt State University, Arcata, CA
Derek Booth	Adjunct Professor, Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA
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Andrew Lee	Combined Sewer Overflow Program Manager, SPU
Mike Milne	Integrated Plan Consultant Team Project Manager, Brown and Caldwell
Bill Ross	Expert Panel Facilitator, Ross Strategic
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Rex Davis	SPU
Louise Kulzer	SPU
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Aaron Poresky	Geosyntec Consultants
Eric Strecker	Geosyntec Consultants
Jennifer Tice	Ross Strategic
Alison Evans	Washington State Department of Ecology
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Rachel McCrea	Washington State Department of Ecology
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